


SITE ASSESSMENT WORK PLAN


FOR

**ANGELES CHEMICAL COMPANY
8915 SORENSEN AVENUE
SANTA FE SPRINGS, CALIFORNIA**

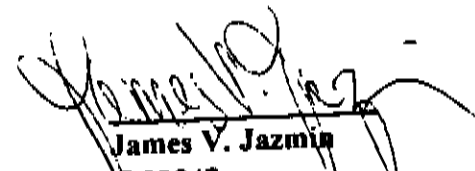
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ANINS000071

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1.0) INTRODUCTION

Blakely Environmental Investigations, Inc. (BEI) was contracted by Angeles Chemical Company, Inc. ((562) 945-3911) to prepare a work plan to determine the lateral extent of volatile organic compound (VOC) soil vapors beneath their facility located at 8915 Sorensen Avenue, Santa Fe Springs, California (See Figure 1, Site Location Map). In addition, BEI proposes to perform a groundwater monitoring episode to identify the extent of dissolved phase VOCs beneath the site. The proposed work was requested by the Department of Toxic Substances Control (DTSC) in a meeting held at the Glendale offices on June 2, 2000.

2.0) SITE LOCATION AND HISTORY

The site is approximately 1.8 acres in size and completely fenced. The site was bound to Sorensen Avenue on the east, Liquid Air Corporation to the northwest, Plastall Metals Corporation to the north, and a Southern Pacific Railroad easement and McKesson Chemical Company to the south.

The property was owned by Southern Pacific Transportation Company and was not developed until 1976.

The Angeles Chemical Company has operated as a chemical repackaging facility since 1976. A total of thirty-four underground storage tanks (USTs) are presently at the site with one additional UST used as a containment for surface runoff or spillage. Chemicals which have been stored and used on site include, but are not limited to, acetone, methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), tetrachloroethene (PCE), methyl ethyl ketone (MEK), toluene, xylene, kerosene, diesel, and unleaded gasoline.

In January 1990, SCS conducted a site investigation. SCS advanced eight borings from 5' below grade (bg) to 50' bg. Soil samples collected and analyzed identified benzene, 1,1-Dichloroethane (1,1-DCA), 1,1-Dichloroethene (1,1-DCE), MEK, methyl isobutyl ketone (MIBK), toluene, 1,1,1-TCA, PCE, and xylenes at detectable concentrations.

In June 1990, SCS performed an additional site investigation at the site by advancing six additional borings advanced from 20.5' bg to 60' bg. A monitoring well (MW-1) was also installed. Soil sample analysis identified detectable concentrations of the above mentioned VOCs in addition to acetone and methylene chloride. Dissolved benzene, 1,1-DCA, 1,1-DCE, PCE, TCE, and trans-1,2-dichloroethene were detected in MW-1 above allowable levels.

Between 1993 and 1994, SCS performed further testing at the site. Soil samples were collected from nine borings. Five borings were converted to groundwater wells MW-2 through MW-6. The predominant compounds detected in soil were acetone, MEK, MIBK, PCE, toluene, 1,1,1-TCA, TCE, and xylenes. Groundwater sample collection and analysis identified the following using EPA method 624:

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following using EPA method 624:

Component Analyzed	MW-1	MW-2	MW-3	MW-4	MW-6	MW-7
Benzene	194	<100	63	111	795	46
1,1-DCA	649	1,130	85	1,410	2,260	2,130
1,2-DCA	<100	<100	<50	<100	1,140	31
1,1-DCE	2,210	2,460	2,800	806	1,240	151
Ethylbenzene	333	1,720	115	1,180	1,910	45
Methylene Chloride	1,220	2,980	6,530	4,760	21,400	<50
PCE	662	2,150	5,370	3,320	2,130	134
Toluene	560	7,390	579	12,700	13,500	398
1,1,1-TCA	9,370	3,470	444	36,200	114,000	90
TCE	7,160	3,040	1,730	14,300	1,320	45
Xylenes	1,750	7,790	1,014	4,362	4,710	186
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L

In 1996, SCS performed separate soil vapor extraction pilot testing beneath the site at approximately 10' bg and 22' bg. Laboratory analysis identified maximum soil vapor gas concentrations as 1,1,1-TCA (30,300 ppmV) with detectable concentrations of 1,1-DCE, TCE, methylene chloride, toluene, PCE and xylenes. The maximum radius of influence from the various extraction units used were measured as 35 feet at 10' bg and 80 feet at 22' bg.

In November 1997, SCS performed a soil vapor survey at the site. Soil vapor samples were collected at twelve locations at 5' bg. In addition, soil vapor samples were collected at 15' bg in five of the twelve sampling points. The soil vapor survey identified maximum VOC contaminants near the railroad tracks on site, the location where a rail tanker reportedly had an accidental release.

3.0) SITE GEOLOGY/HYDROGEOLOGY

Two aquifers were identified by SCS during subsurface investigations performed at the site. A perched aquifer was encountered at approximately 23' bg and the Gaspar/Hollydale aquifer was encountered at 20' to 35' bg by SCS. In January 1999, the piezometric surface was identified at approximately 30' bg.

SCS identified silty clays with some minor amounts of silt and sand in the shallow subsurface from surface grade to approximately 15' bg. Below the silty clay, poorly sorted coarse-grained sand and gravel from 15' bg to 26' bg. A less permeable silty clay layer was identified by SCS between 35' and 50' bg, which contains stringers of fine sand and silt that is part of the Gaspar/Hollydale aquifer.

BEII proposes that a soil vapor gas survey be performed at the site to confirm the lateral extent of soil vapors beneath the site. A well head survey will be conducted at the site to calculate an accurate groundwater gradient. Groundwater collection and analysis is also proposed to identify the extent of dissolved phase halogenated and aromatic petroleum hydrocarbons beneath the site. Details of the proposed work are provided in the following sections.

4.1) Soil Vapor Survey

Soil vapor gas collection points will be advanced to 5' bg and 10' bg with a direct push hydraulic rig (See Figure 3, Soil Vapor Sample Locations). In addition, any existing soil vapor monitoring points on-site will be used for soil vapor collection. A 1 1/4-inch diameter probe rod with a retractable point is advanced to the desired depth. Once the desired depth is reached, 3/8-inch extension rods are installed down the 1 1/4-inch diameter probe rods to remove the point lock pin. When the lock pin is removed, the 1 1/4-inch diameter probe rod is withdrawn 6-inches and the point is left in place. A continuous flow air pump and PVC tubing will be used to collect the soil vapor samples. Soil vapors will be purged for a minimum of five minutes to ensure that representative soil vapors are collected. Vapor samples will be collected in labeled 1-liter Tedlar bags and packaged for transport to a California certified toxics analysis laboratory where they will be analyzed for TPH-g, BTEX, and VOCs using EPA methods 8015 modified, 8020, and 8260, respectively.

4.2) Wellhead Survey and Groundwater Sampling

Prior to groundwater sampling, all groundwater monitoring and soil vapor extraction wells will be surveyed by a California Registered Civil engineer. The well locations will be recorded using the California Plane coordinate system. The height of a reference survey datum will be determined within +/- 0.01 foot in relation to mean sea level. The surveyed datum point will be permanently marked on top of the inner well casing.

Groundwater measurements will be performed at the site using an oil/water interface probe. The interface probe will be capable of measuring free product thickness and/or depth to groundwater in the well to within 0.01 foot. Proper decontamination using a triple rinse of Liquinox water, potable water, and deionized water will be performed on the interface probe after every well. A total of three well volumes will be purged from each well prior to sample collection using a submersible pump or Teflon bailers. Groundwater parameters (pH, temperature, and conductivity) will be measured before, during, and after well purging. The purged groundwater will be stored in 55-gallon hazardous waste drums for disposal at a later date using a licensed hazardous waste hauler. Once groundwater parameters stabilize to within 90% of the initial measurements, groundwater samples will be collected using disposable Teflon bailers. A new Teflon bailer and Nitrile gloves will be used for each well.

Groundwater samples will be placed in an ice chest for transport under chain of custody

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protocol (See Section 5.2 of this report) to a California Department of Health Services certified laboratory. Groundwater samples will be analyzed for total petroleum hydrocarbons as gasoline (TPH-g), VOCs, semi-volatile organic compounds (SVOCs), and metals using EPA methods 8015 modified for gasoline, 8260B, 8270C, and 6010B/7471A, respectively.

4.3) Analytical Methods and Quality Assurance

A California Department of Health Services certified laboratory would conduct all chemical analysis of site samples. The chosen laboratory will maintain strict conformance to EPA standard methodologies, quality assurance/quality control (QA/QC) protocols and standard laboratory practices supporting EPA procedures.

4.4) Schedule

Following acceptance of the work plan by the DTSC, on site test activities will commence within thirty days.

5.0) FIELD DOCUMENTATION AND CHAIN-OF-CUSTODY

The following sections describe the recording system for documenting all site field activities and the sample Chain-of-Custody Program.

5.1) Field Log Book

An accurate chronological recording of all field activities is vital to the documentation of any environmental investigation. To accomplish this, bound and numbered field logbooks will be maintained by the field team to provide a daily record of significant events, observations, and deviations from the work plan and measurements collected during the field activities. The BEII on Site Supervisors will determine the necessity for any deviations from the work plan. The records will contain sufficient information so that the work activities can be reconstructed without relying on the collector's memory. All entries will be signed, dated and made with waterproof ink. Corrections to the logbook will be made by drawing one line through the error, initialing and dating. The logbook will always be stored in a secure location.

5.2) Chain-of-Custody

The objective of the Chain-of-Custody Program is to allow the tracking of possession and handling of individual samples from the time of field collection through laboratory analysis. Once a sample is collected, it becomes part of the Chain-of-Custody process. A sample is "in custody" when (1) it is in someone's possession; (2) it is within visual proximity of that person; (3) it is in that persons possession, but locked up and sealed (e.g. during transport); and (4) it is in a designated secure sample storage area.

5.2.1) Chain-of-Custody Record and Request for Analysis Report

Chain-of-Custody records establish the documentation necessary to trace sample possession from the time of collection to analysis. A serialized Chain-of-Custody and Request for Analysis Report will be completed and will accompany each batch of samples. The record will contain the following information.

- * Project name and number;
- * Request for Analysis control number (for cross reference);
- * Names of sampling team members;
- * Laboratory destination;
- * Carrier/waybill number;
- * Sample number;
- * Sample location and description;
- * Date and time collected;
- * Sample type;
- * Container type;
- * Special instructions;
- * Possible sample hazards;
- * Signatures of persons involved in the chain-of-possession.

When sample custody is transferred to another individual, the samples must be relinquished by the present custodian and received by the new custodian. This will be recorded at the bottom of the Chain-of-Custody Record and Request for Analysis Report where the persons involved will sign, date and note the time of transfer. During field operations, each project geologist will act as the custodian for the samples he or she collects. Samples will not be left unattended unless placed, along with the Chain-of-Custody Record, in a secure container.

The Chain-of-Custody Record and Request for Analysis Report is a multi-part form that allows the record to be kept in duplicate. One copy will accompany the sample shipment to the laboratory and one copy will be kept with the field logbook. All documents that accompany shipments will be enclosed in zip-lock bag and taped to the inside top cover of the shipping container.

Chain-of-Custody and Request for Analysis Reports provide official communication to the laboratory by listing the particular analysis required for each sample. This also furnishes further evidence that the Chain-of-Custody is complete. The form will contain the following information:

- * Cross-reference to the Chain-of-Custody Record;
- * Project name and number;

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- * Sample number;
- * Sample volume;
- * Preservative as required;
- * Requested testing program;
- * Required turnaround time;
- * Possible hazard identification;
- * Sample disposal requirements;

The form will be signed and dated by the receiving laboratory sample management custodian.

5.2.2) Sample Identification

Sample labels prevent the misidentification of samples. Following sample collection, labels will be affixed to each sample container. Labels will record the following type of information.

- * Project name and number;
- * Sample identification number;
- * Name and sample collector;
- * Date and time of collection;
- * Analytical parameters;
- * Known hazards;
- * Pertinent comments;

Labels will be sufficiently durable to remain legible even when wet.

5.2.3) Custody Seals

Custody seals are used to detect unauthorized tampering with samples during storage and transport. Several seals will be attached to each shipping container (iced coolers) in a manner such that the container can not be opened without breaking the seal. Clear strapping tape will be placed over the seals to ensure that seals are not accidentally broken during shipment handling. The following information will be recorded on each seal:

- * Sampler's signature;
- * Date of seal attachment.

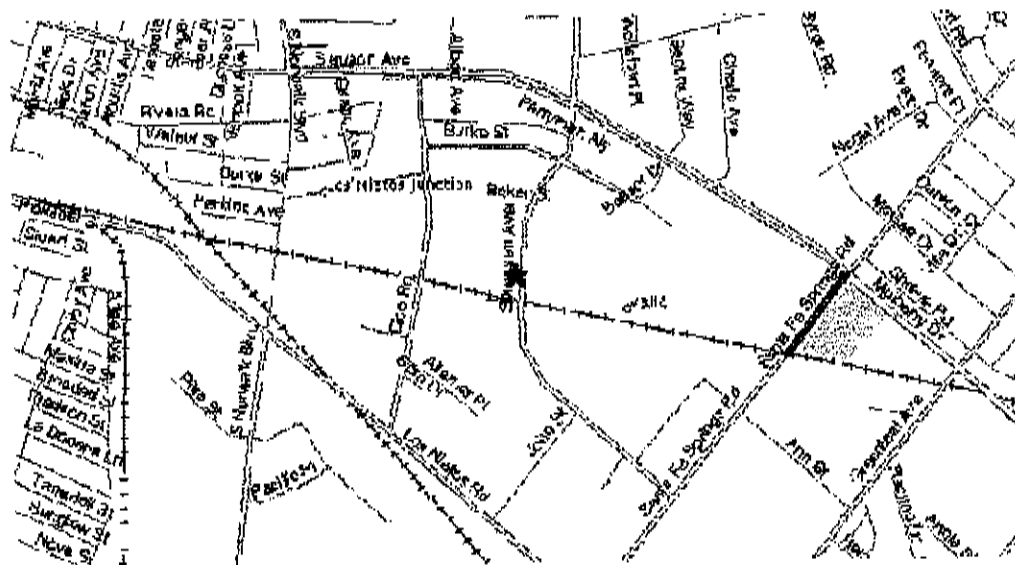
6.0) HEALTH AND SAFETY PLAN

The purpose of the project Health and Safety Plan (HASP) is to provide guidelines and procedures to ensure the health and physical safety of people working at the Angeles Chemical

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Company facility. The goal of the HASP is to provide precautionary and responsive measures for the protection of on-site personnel, the general public and the environmental. A HASP is included as Appendix A.

Figures



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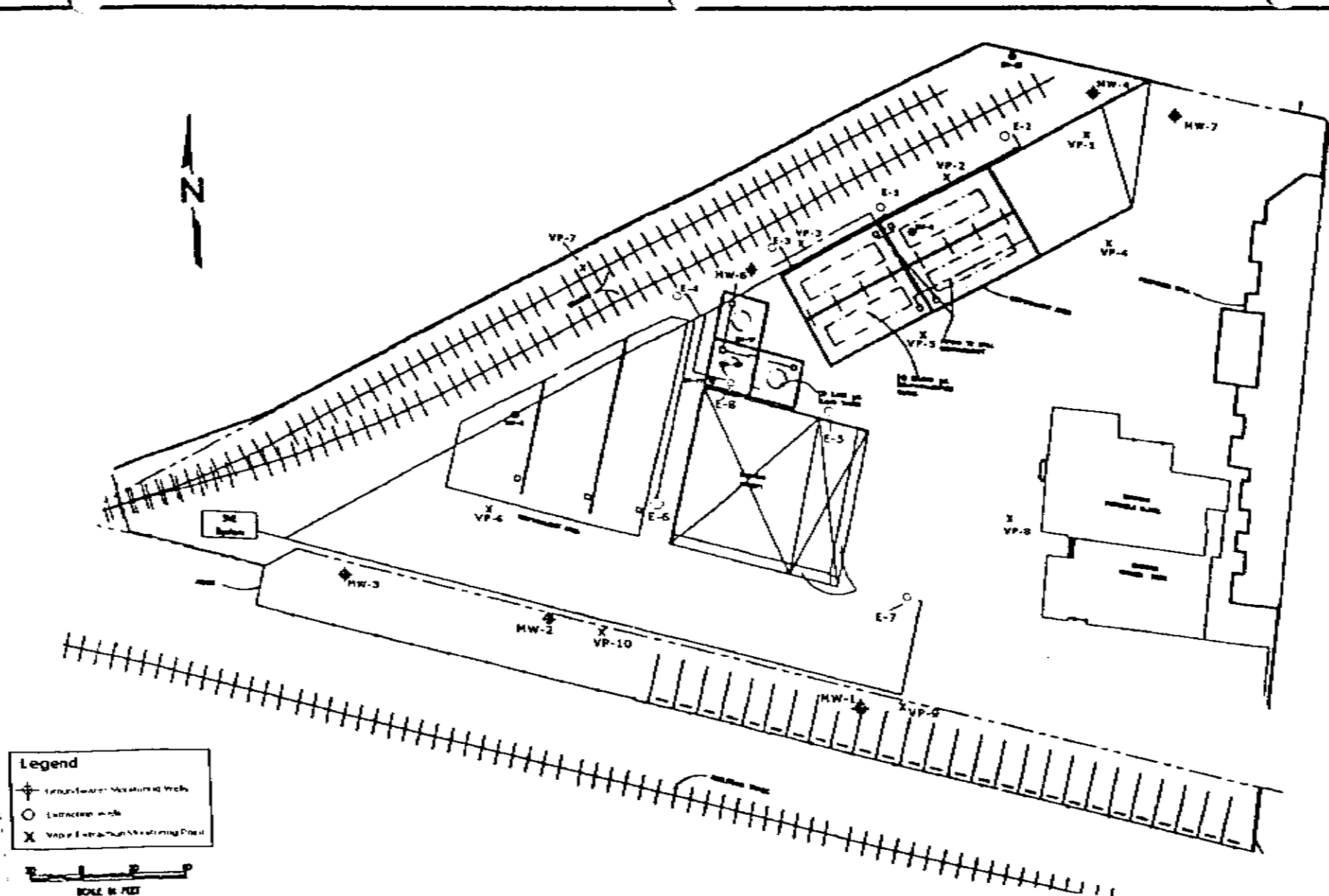
Site Location

Angeles Chemical Company
8915 Sorensen Avenue
Santa Fe Springs, CA

Figure 1

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Taken from SCS Report

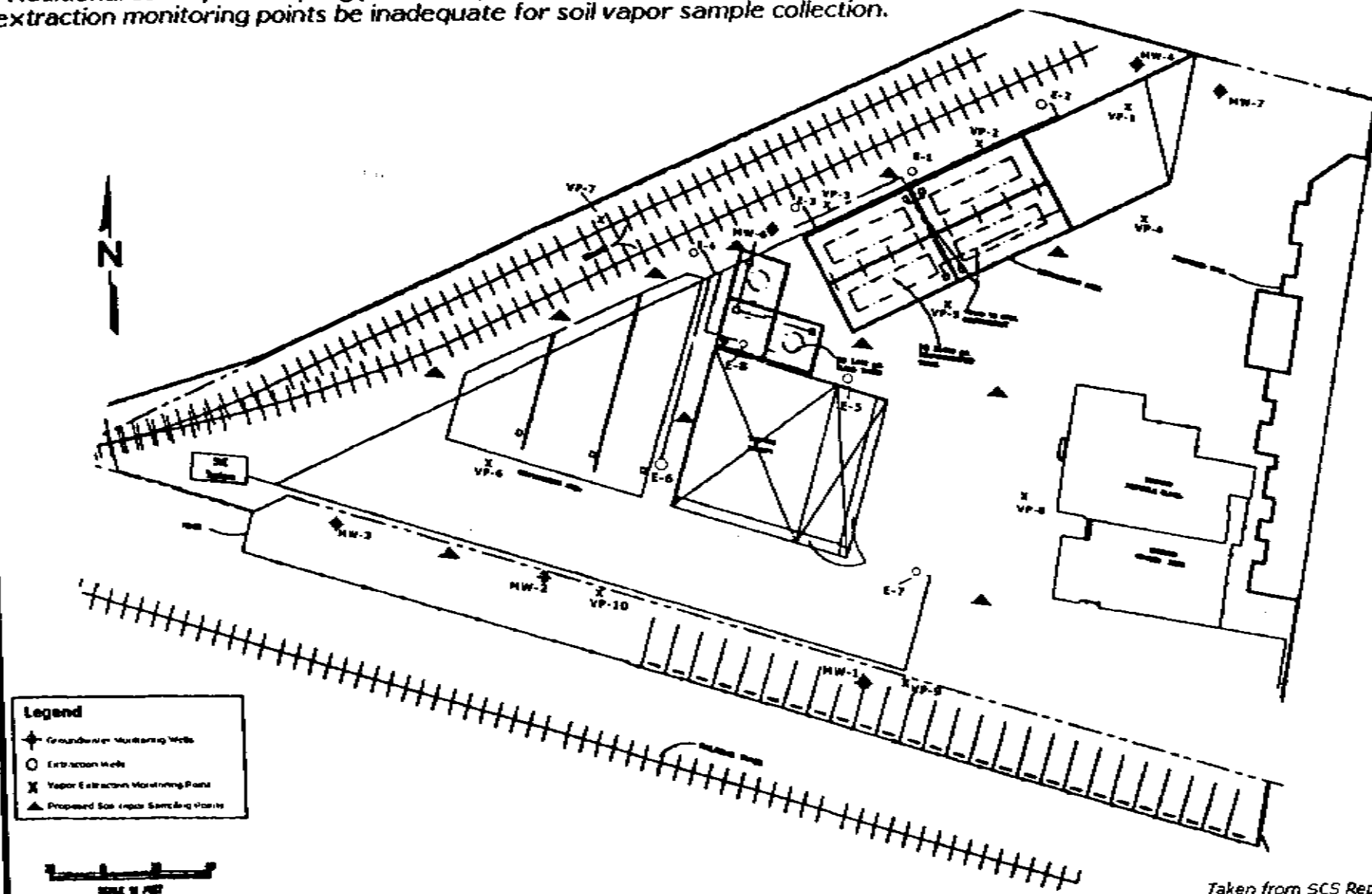
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Site Layout

Angeles Chemical Company
8915 Sorensen Avenue
Santa Fe Springs, CA

Figure 2

*Additional soil vapor sampling points may be necessary should vapor extraction monitoring points be inadequate for soil vapor sample collection.



Taken from SCS Report

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Soil Vapor Sample Locations

Angeles Chemical Company
8915 Sorensen Avenue
Santa Fe Springs, CA

Figure 3

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Appendix A

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HEALTH & SAFETY PLAN

**ANGELES CHEMICAL COMPANY
8915 SORENSEN AVENUE
SANTA FE SPRINGS, CALIFORNIA**

Site Health & Safety Plan

Health and Safety Plan Personnel

The following personnel will be responsible for the implementation and enforcement of the Health and Safety provisions outlined herein.

Project and Field Health & Safety Manager

Mr. James Jazmin
Project Manager / Registered Civil Engineer
Blakely Environmental Investigations, Inc.
1473 Highway 2, Suite 2 / P.O. Box 339
Wrightwood, California 92397
(760) 249-5498

As the Project Manager (PM) and Field Health & Safety Manager (HASM), Mr. Hiram Garcia is responsible for assuring that the overall project objectives are met, and that the HASP is properly implemented. As the PM/HASM, he will be the primary onsite contact throughout the field program, and he has the authority to commit the resources necessary to meet project and HASP objectives and requirements. He will assure that proper materials, instruments, and qualified personnel are available and will designate the individuals to implement the sampling and analysis programs. He will perform the following tasks:

- ◆ Implement and enforce health and safety provisions for Blakely Environmental Investigations, Inc. and its subcontractors;
- ◆ Approve a detailed schedule for site activities;
- ◆ Establish project policy and procedures to address specific needs of the project as a whole, as well as the objectives of each task;
- ◆ Acquire and apply Blakely Environmental Investigations, Inc. technical, Health & Safety and corporate resources as needed to ensure performance within budget and schedule restraints, and as per HASP guidelines;
- ◆ Oversee the collection, compilation, and review field and laboratory analytical data;
- ◆ Present, explain and document presentation of HASP revisions to project staff;
- ◆ Evaluate site conditions and communicate the health and safety concerns associated with the conditions
- ◆ Coordinate efforts of the Corporate Health & Safety Officer, and outside experts; and
- ◆ Provide consultation on the selection and use of personal protective equipment.

Corporate Health and Safety Officer

Mr. Hiram Garcia
Corporate Health & Safety Director
Blakely Environmental Investigations, Inc.
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Wrightwood, California 92397
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The corporate Health and Safety Officer is responsible for the development and implementation of the Blakely Environmental Investigations, Inc. Health and Safety Program; this responsibility includes:

- ◆ Disseminate Health and Safety Program information to Blakely Environmental Investigations, Inc. personnel, and update the program as necessary to keep it current with applicable regulatory requirements;
- ◆ Review Health and Safety Plans;
- ◆ Conduct a periodic review of Office and Site Health and Safety Plan implementation; and
- ◆ Provide consultation on health and safety issues.

Selected duties may be delegated to local qualified experts to support site health and safety plans as appropriate.

Project Staff

Each project staff member and subcontractor under the direction of Blakely Environmental Investigations, Inc. will be responsible for the following:

- ◆ Understanding and implementing the requirements of the HASP;
- ◆ Reviewing and understanding the feature specific information regarding the chemical, physical and toxicological characteristics of hazardous materials and/or wastes that may be present or encountered during assigned activities;
- ◆ Understanding and using appropriate health and safety procedures and personal protective equipment;
- ◆ Evaluating working conditions and taking appropriate actions to maintain a safe and healthful work environment; and
- ◆ Advising any member of the project or safety management team of conditions that may adversely affect worker health and safety and take appropriate actions to protect workers.

The proposed project team for the field investigative effort includes Mr. James Jazmin, RCE; Mr. Hiram Garcia, REA II / Toxicologist; Mr. David Blakely, REA II / Sr. Scientist; and Mr. Lance Jost, Environmental Technician. Depending on field conditions encountered during implementation of the investigative program, additional field staff may be assigned, as necessary.

Site-Specific Hazard Evaluation

The previously reported conditions at the subject site and the activities that will be conducted during the field activities have the potential to create exposure to low pH substances that may be hazardous. This section provides an evaluation of the potential hazardous conditions that may be encountered during field activities. Table 1 presents a summary of the COCs historically detected at the subject site and associated exposure limits.

The principal field activities planned for at the site include:

- ◆ Concrete coring
- ◆ Soil sampling
- ◆ Groundwater well installation via drilling and/or direct push technology
- ◆ Groundwater sampling

The conditions anticipated during field activities may lead to exposure to hazardous substances. Exposures are created in the work place by introducing substances into the air or onto surfaces or materials where the workers may come into contact, creating the potential for inhaling, ingesting, or bodily contacting with the substances resulting in surface contact or entry into the body. The following paragraphs describe possible exposure routes of entry during field activities at the site.

Chemical Hazards

The project scope involves the investigation of low pH contamination of soils and groundwater and therefore encountering low pH hazards is likely. Appropriate administrative and engineering controls will be used in the implementation of field activities. Exposures will be controlled through the use of PPE, where administrative controls and engineering controls cannot be applied and when practical. These potential exposures are summarized as follows:

Inhalation

A principal pathway of exposure for low pH soils or groundwater is via inhalation of acid vapors emanating from excavated soils or impacted fluids. Low pH exposure via inhalation for workers and the public will be evaluated via breathing zone monitoring during field activities.

Dermal Contact

The skin is a major protective barrier to all organs of the body. The exterior layer of the skin generally prevents foreign materials from entering the body. However, some contaminants can be absorbed directly through the skin and enter the bloodstream. Absorption of chemicals through the skin will be prevented by the use of PPE, including coated body suit (Saranex™, or equivalent), impermeable gloves which are resistant to low pH materials, and full face splash shields.

Ingestion

Workers may ingest materials unintentionally when they handle food, drink, smoke, etc., after being in contact with the waste material and before thoroughly washing their hands. This risk will be avoided through the use of work practices that prohibit these activities in impacted areas.

Containment

Spill containment will be provided for all operations where there is a potential for spills, releases or discharges. Spill containment will consist of providing sufficient quantity of absorbent material to contain a potential release. For the purposes of this HASP, spills can occur during groundwater sampling and equipment and personnel decontaminating. The largest container used for decontamination purposes will be a 55-gallon drum. In order to minimize the amount of possible release, the 55-gallon drums will only be filled halfway. During groundwater sampling, groundwater will be purged using a submersible pump and groundwater will be stored in Department of Transportation (DOT) approved 55-gallon drums. Spills may occur during relocation of 55-gallons drums containing well purge water and decontamination water from the work area to the drum storage area. To minimize the amount of possible release, all drums will be closed with the seal in place prior to moving. Drums will be moved using either a drum dolly or a forklift with a drum handler.

Designated Levels of Protection

The rationale for selection of personal protective equipment (PPE) for use during this field program is based on historic knowledge of COC present at the site, the potential methods of exposure, the engineering controls available to mitigate exposure, and the effectiveness of the PPE for the anticipated exposures. Levels A and B are not expected to be necessary for the field activities at this site.

Level C is specified when monitoring for COCs indicate that the permissible exposure limit (PEL) indicated in Table 1 is exceeded. The following section provides details of the air-monitoring program as well as action levels for potential health & safety level upgrade.

Level D or modified level D (no splash suit) will be the minimum level of protection for all activities at the site. Direct monitoring will allow routine surveillance of the work area to detect ranges that may necessitate an increase in the level of PPE to assure the health & safety of workers.

Environmental Surveillance

The objective of environmental surveillance is to monitor the work area to ensure protection of workers and the public. Environmental surveillance will consist of ambient air monitoring and heat stress monitoring of workers. All environmental surveillance will be conducted under the direction of the HASM. Monitoring results are compared to action levels or other criteria defined in this HASP. If action levels are exceeded, corrective action; including stopping work, upgrading PPE, and/or using engineering controls; will be initiated. The action levels are based on published guidelines and regulatory requirements and procedures. Any additional requirements which may result from unplanned changes in site activities or conditions or identified in any governmental permits which may be obtained as required to complete certain types of work, will be addressed in addenda to the HASP.

Initial Air Monitoring

Initial air monitoring of work areas will be performed prior to initiation of work tasks. Initial air monitoring will be conducted to identify background volatile organic concentrations and to monitor for any IDLH or other potentially hazardous situations. Due to the potential presence of low pH in soil and groundwater, initial air monitoring will be performed in the vicinity of each proposed investigation location. If required by the HASM, air monitoring will also be conducted at the beginning of each workday to confirm that conditions have not changed during off-shift periods. Monitoring will be conducted in the immediate work area and breathing zone at 30-minute intervals for soil sampling/well installation work.

Initial air monitoring will be performed using real-time field survey instrumentation capable of monitoring the following parameters:

- Halogenated Hydrocarbon vapors;
- Ketone vapors;
- Concentration of airborne particulates

Periodic Air Monitoring

Air monitoring will also be performed on a periodic basis during selected field activities for the same parameters identified for initial air monitoring. Periodic monitoring will be performed, at a minimum, when occurrence of dust, which may contain COCs generated during field activities, is either observed, or when the particulate air-monitoring device indicates an exceedance the action level discussed in the next section.

Monitoring Criteria, Survey Instrumentation, and Action Levels

Selection of survey instrumentation, criteria for use, and action levels for initial and periodic monitoring have been identified for each of the monitoring parameters. Air monitoring for airborne particulates will be performed at shoulder height (in the breathing zone) at each investigation location. Particulate monitoring will be conducted using an HNU Photo Ionization Detector (PID) calibrated to detect PCF, TCE, and

ketones; and a Foxboro Flame Ionization Detector (FID) calibrated to detect short carbon chain petroleum aromatics.

The following action levels have been established for the identified COCs for field activities:

Chemical	CalOSHA Permissible Exposure Limit(PEL)	Action Level
TCE / PCE	100 ppm / 5 ppm respectively	100ppm, based on particulate meter detection and Draeger tube confirmation -- upgrade to Level C.
BTEX	100 ppm	100 ppm, based on particulate meter detection, a Draeger tube confirmation -- upgrade to Level C.
Ketones	NA	NA

Use and Maintenance of Survey Instrumentation

All personnel using field survey instrumentation will be thoroughly instructed on the operation, limitations, and maintenance of these devices by the HASM or other qualified individual designated by the HASM. Air monitoring equipment used during field activities will be calibrated on a daily basis and maintained as necessary based on equipment specifications. All maintenance and calibration procedures will be in strict accordance with the manufacturer's guidelines by a designated individual familiar with the devices.

Respirator Selection and Use

When action levels identified in Table 1 are exceeded, the HASM will decide whether to institute engineering controls (i.e. enhanced ventilation) or designate an upgrade in PPE. When level C PPE is specified, the following air-purifying respirator have been selected for use:

- Half-face, air-purifying respirator equipped with cartridges for organic vapor/acid gases and a HEPA filter;
- Full-face, air-purifying respirator equipped with cartridges for organic vapor/acid gases and a HEPA filter

Air-purifying respirators are only to be used in connection with breathing space air monitoring, and with strict adherence to the action levels identified in Table 1.

The following limitations are items that preclude the use of air-purifying respirators:

- Oxygen-deficient atmosphere (less than 19.5% oxygen);
- Concentrations of substances which may be IDLH (see Table 1);
- Entry into unventilated areas which may contain airborne contaminants that have not been characterized;
- Unknown contaminant concentrations, or concentrations which exceed designated maximum use levels; or
- High relative humidity (reduces sorbent life).

Respirators will be assigned to each person performing fieldwork based on a fit test. Respirators issued to individuals will be cleaned and disinfected after each use. Respirators will be inspected daily and any necessary repairs will be made at that time. Damaged respirators will not be worn. After cleaning and prior to leaving the work site for the day, respirators will be placed in clean, plastic bags and stored in a clean location convenient to the work areas. The following representative respirator cleaning and inspection procedures are to be used during field activities:

Daily Air-Purifying Respirator Inspection and Checkouts:

- Visually inspect the entire unit for any obvious damages, defects, or deteriorated rubber;
- Make sure that the facepiece harness is not damaged;
- Inspect lens for damage and proper seal in facepiece. Exhalation Valve - Pull off plastic cover and check valve for debris or for tears in the neoprene valve (which could cause leakage);
- Inhalation Valve (two) - Unscrew cartridges and visually inspect neoprene valves for tears.
- Make sure that the inhalation valves and cartridge receptacle gaskets are in place;
- Make sure the speaking diaphragm retainer ring is hand tight; and
- Don and perform negative pressure test.
- Respirator Disassembly: Respirators are taken to a clean location where the cartridges are removed, and if damaged discarded to prevent accidental reuse. For thorough cleaning, the inhalation and exhalation valves, speaking diaphragm, and any hoses are removed;
- Cleaning: In most instances, the cleaning and disinfecting solution provided by the manufacturer is used, and is dissolved in warm water in an appropriate tub. Using gloves, the respirator is placed in the tub and swirled for a few moments. A soft brush may be used to facilitate cleaning;
- Rinsing: The cleaned and disinfected respirators are rinsed thoroughly in water to remove all traces of detergent and disinfectant. This is very important for preventing dermatitis;
- Drying: The respirators may be allowed to dry in ambient air on a clean surface. They may also be hung upside-down but care must be taken not to damage or distort the facepieces; and
- Re-assembly and Inspection: The clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. Special emphasis should be given to inspecting the respirators for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve, and can cause valve leakage or sticking.

After Routine Use in Exclusion Zone:

- The mask may be washed/rinsed with soap and water;
- At a minimum, the mask should be wiped with disinfectant wipes (benzoalkaloid or isopropyl alcohol), and allowed to air dry in a clean area; and
- The mask will be stored in a plastic bag away from the sun and other potentially degrading chemical or physical environments.

The effectiveness of the respiratory protection program will be monitored by the HASM or his designee. Monitoring of worker stress levels during activities that may require respiratory protection will also be performed by the HASM or his designee.

Respirator Change Out Schedule

Change out schedules for respirators to be potentially used on site are conservatively based on an OSHA rule of thumb for acid gas. At a hypothetical concentration of 200 ppm, which greatly exceeds even the IDLH concentration for each COC, an 8 hour estimated life is appropriate for both hydrochloric and sulfuric acid gases, at normal work rates. Since this concentration greatly exceeds those anticipated and permitted for work at the site, an 8-hour (daily) change out for respirator cartridges, when donned, will be adhered to. This schedule provides a substantial safety factor for site workers. The conservatively estimated change out times are identical for both the half-face and full-face respirators and apply to the North Safety™ brand outfitted with the organic vapors and acid gases cartridge (Model # 75SC), which are designated for use at the site.

Decontamination

As part of the system to prevent or reduce the physical transfer of contaminants by people and/or equipment from on-site, procedures shall be instituted for decontaminating, or preventing contamination of anything leaving the Contaminant Reduction Zone (CRZ), for Level C operations. These procedures included the decontamination of PPE, monitoring equipment, clean-up equipment, etc.

All personnel performing work tasks in a designated contaminant Exclusion Zone must pass through the decontamination procedure established at each work site. If required, decontamination will take place within a CRZ, which will serve as the sole entry and exit point between the exclusion zone and safety zone at each work site. The HASM will monitor decontamination procedures for their effectiveness in preventing migration of contaminants from the CRZ.

Personnel Decontamination

Personnel decontamination for Level C and Level B operations will be completed according to the guidance given in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. Personnel and PPE will be decontaminated using water or a mixture of detergent and water. All liquid and solid waste generated from the rinsing or decontamination will be collected and stored on-site pending treatment and/or disposal.

Required Procedures

Personnel who have donned level C PPE and entered the CRZ or the Exclusion Zone must use all decontamination procedures prescribed, regardless of the type or amount of work performed in these controlled zones.

Order of Decontamination

Personnel shall wash and remove PPE in the order and steps found in the decontamination procedures outlined below. At a minimum, gross removal of contaminants from the PPE, removal of the PPE, and washing of hands and face shall be required upon exiting the CRZ or entering the designated Clean Areas.

Field Wash

A field wash (rinse of the face, and hands) is required before entering the Clean Areas. Drinking, smoking, or any activity involving hand-to-mouth action, and use of the toilet facilities in the Clean Areas requires a field wash.

Decontamination Procedures

Level D Decontamination

The following expected minimum decontamination action procedures may be used for those sites requiring Level D protection:

- ◆ Gross Contamination Removal
 - Remove any loose soil from PPE and equipment.
- ◆ Safety Boot Removal

-Remove safety boots and place away from Clean Area.

- ◆ **Glove Removal**

-Remove gloves and deposit in trash container

- ◆ **Field Wash**

-Wash hands and face.

Level C Decontamination

The following expected minimum decontamination procedure will be employed for those areas where Level C safety protection may be required:

- ◆ **Gross Contamination Removal**

-Remove any loose soil from PPE and any equipment.

- ◆ **Segregated Equipment Drop**

-Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers.

- ◆ **Boot Cover and Glove Wash**

-Scrub outer boot covers (if used) and gloves with decontamination solution or detergent/water.

- ◆ **Boot Cover and Glove Rinse**

-Rinse off decontamination solution from Station 2 using copious amounts of water. Repeat as many times as necessary.

- ◆ **Tape Removal**

-Remove tape around boots and gloves and deposit in trash container.

- ◆ **Boot Cover Removal**

-Remove boot covers (if used) and deposit in container with plastic liner. Reusable boots will be washed with copious amounts of decontamination solution or detergent/water.

- ◆ **Glove Removal**

-Remove gloves and if disposable, deposit in container with plastic liner. Nitrile gloves will be washed with copious amounts of decontamination solution or detergent/water.

- ◆ **Suit Wash**

-Thoroughly wash splash suit. Repeat as many times as necessary.

- ◆ **Suit Rinse**

-Rinse off decontamination solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

- ◆ **Cartridge or Mask Change**

-If worker leaves Exclusion Zone to change cartridges (or mask), this is the last step in the decontamination procedure. Worker's cartridges are exchanged, new gloves and boots covers donned, and joints taped. Worker returns to duty.

Emergency Response Procedures

The following standard emergency procedures will be used by on-site personnel.

Site Emergency Warning System

Site warning systems may be utilized depending on the work site conditions and the type and the degree of emergency involved. Among those available are:

- ◆ Verbal communications
- ◆ Vehicle horns
- ◆ Telephones

Verbal Instructions

Verbal instructions with or without assistance are used to deal with specific incidents.

Horn Signals

Horn signals are used to signify an emergency warning.

Emergency Site Evacuation Signal

One long blast of vehicular or compressed air horn is used on-site to signify emergency evacuation of the immediate work area to the predetermined rally point (as covered in the daily safety meetings), where a head count shall be taken and further instructions given.

Exclusion Zone Evacuation Signal

Repeated short blasts are used on-site or from off-site to signify evacuation of all personnel from the Exclusion Zone to the decontamination line of the CRZ where further instructions shall be given after a head count is taken.

Evacuation Procedures

In case of an emergency or hazardous situation, the personnel member that observes this condition shall immediately give the alarm.

- ◆ Communications Priority - Upon hearing an alarm, all communications shall cease and the member giving the alarm shall proceed to give the HASM or designated coordinator all pertinent information;
- ◆ Response Actions - Actions to be taken shall be dictated by the type of emergency. The HASM shall be summoned and shall address all emergency situations;
- ◆ Equipment Shutdown - Power equipment will be shut down and not moved until instructions are received from the HASM or designated coordinator;
- ◆ Rally Point - in case of a fire, explosion and/or hazard alarm, individuals will proceed to the rally point assigned in the daily "tail-gate";
- ◆ Head Count - Upon arrival at the rally point, a complete head count shall be taken by the HASM or designated coordinator. Personnel should remain at the rally point until the area is secured and they receive and "all clear" from the HASM or designated coordinator.

Evacuation Routes

The HASM or his designee will discuss the rally points during the daily "tail-gate" safety meetings. A map indicating routes of evacuation will be posted at each work area and will be revised as necessary by the HASM. If the evacuation routes change as the field activities progress, a revised route map will be added as addenda to this HASP.

Site Control

Work areas may be divided into site control zones that include Exclusion Zones, Contamination Reduction Zones (Decontamination Zones), and Support Zones. At a minimum, Exclusion Zones will be designated through the use of barricade tape. Access to Exclusion Zones will be restricted to authorized persons. Any visitors to the area must be authorized to be on site. Visitors must read, sign and comply with all aspects of the HASP. If needed, enforcement of above procedures will be provided by Blakely Environmental Investigations, Inc.'s PM/HASM. The PM/HASM shall identify those work areas which visitors/personnel are authorized to enter, and enforce site control measures.

Because the site will encompass many work areas, site control zones will be established for each field activity area as activities are initiated. Each site control zone will include the elements presented below as necessary. Site control zones will be documented in the field log.

Zone 1: Exclusion Zones

Visually designed exclusion zones will be established around each work area in which certain tasks are to be performed and each will be of sufficient size to contain all work activities and resultant waste products within that area. The perimeters of each exclusion zone will be defined with barricade tape, or barricades in order to restrict access to the work area. In some cases the exclusion zone will be the physical feature itself, such as a monitoring well. Work tasks that will require the establishment of an exclusion zone around the proposed work area(s) including all hand-augering, drilling, and sampling activities.

Zone 2: Contamination Reduction (Decontamination) Zones

The contamination reduction zone (CRZ) provides a transition between the Exclusion Zone and the Support Zone. A decontamination line will be established within the CRZ, and will serve as the sole entry and exit point for the exclusion zone. The CRZ decontamination station will contain facilities for the

decontamination of personnel and portable equipment. If steam cleaning is performed on-site, an area will be designated for the decontamination of vehicles, drilling equipment, etc. at a location readily accessible to the areas under investigation. Visitors are not permitted to enter the decontamination zone.

Zone 3: Support Zones

The support zone will be situated in clean areas outside of the CRZ, where the chance of encountering hazardous materials/conditions is minimal.

Communications

Personnel working in the Exclusion Zones will be within visual or verbal contact with each other. The locations of telephones to be used for emergencies will be identified during the tailgate meeting. The following hand signals will be employed by field personnel using Level C PPE in emergency situations:

<u>Signal</u>	<u>Definition</u>
Hands clutching throat	Out of air/cannot breathe
Hands on top of head	Need Assistance
Thumbs up	OK/I'm alright/I understand
Thumbs down	No/negative
Arms waving upright	Send back support
Grip partners wrist	Exit area immediately

Safe Work Practices

Safe work practices to be used during the field activities include the following items:

- ◆ Field personnel, inspectors, etc., will enter designated exclusion zones only through the CRZ. All personnel leaving an Exclusion Zone must exit the Exclusion Zone through the CRZ and pass through the CRZ decontamination procedure;
- ◆ Only the vehicles and equipment required to complete work tasks will be permitted within an Exclusion Zone (i.e., excavation equipment, drill rigs, support trucks, etc.). Nonessential vehicles will remain within the Support Zone;
- ◆ Containers (i.e., roll-off bins, drums, etc.) will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport;
- ◆ Excellent housekeeping shall be maintained. Debris shall be collected in appropriately marked containers and all work areas kept free of such material. Equipment decontamination areas shall be maintained in an orderly, clean condition at all times. A wet/dry vacuum will be used to remove concrete coring sludge as it is generated;
- ◆ The "buddy system" will be employed during activities within an Exclusion Zone when wearing Level C. Communication between members must be maintained at all times. Emergency communications, to be used when radios are not on site, shall be prearranged. Visual contact must be maintained between buddied pairs on-site and each team should remain in close proximity to allow assistance to each other in case of emergencies;
- ◆ Personnel will avoid contact with potentially contaminated substances. Walking through puddles or mud, or kneeling on the ground, should be avoided whenever possible;
- ◆ Equipment will not be placed on possibly contaminated surfaces;
- ◆ Eating, drinking, chewing gum or tobacco, smoking, or any practices that presents the possibility of hand to mouth transfer and ingestion of materials is prohibited in any and all areas where the possibility of contamination exists. At a minimum, this includes the Exclusion Zone and the CRZ;

- ◆ Hands must be thoroughly washed upon leaving any area designated as contaminated or suspected of contamination. No eating, drinking, smoking, or other similar activities may be performed before hands are thoroughly washed;
- ◆ No matches or lighters will be permitted in the Exclusion Zone or CRZ;
- ◆ Contaminated protective equipment, such as respirators, hoses, boots, disposable protective clothing, etc., will not be removed from the Exclusion Zone or CRZ until it has been cleaned, or properly packaged and labeled;
- ◆ All personnel will be required to field wash (hands and face) at a minimum at the end of their shift before leaving the job site;
- ◆ Field personnel must observe each other for signs of toxic exposure and heat/cold illness. Indications of adverse effects include, but are not limited to, the following disorders:
 - Changes in complexion and skin discoloration
 - Changes in coordination
 - Changes in demeanor
 - Excessive salivation and pupil response
 - Changes in speech pattern.
- ◆ Field personnel are cautioned to inform each other of non-verbal effects of illness such as the following ailments:
 - Headaches
 - Dizziness
 - Nausea
 - Blurred Vision
 - Cramps
 - Irritation of eyes, skin, or respiratory tract.

A well-delineated clean area for breaks, the clean area, shall be established between the initial decontamination procedures set-up and the entry to the decontamination area. Unless otherwise prohibited, smoking, fluid intake and the use of rest room facilities shall be permitted in the clean areas.

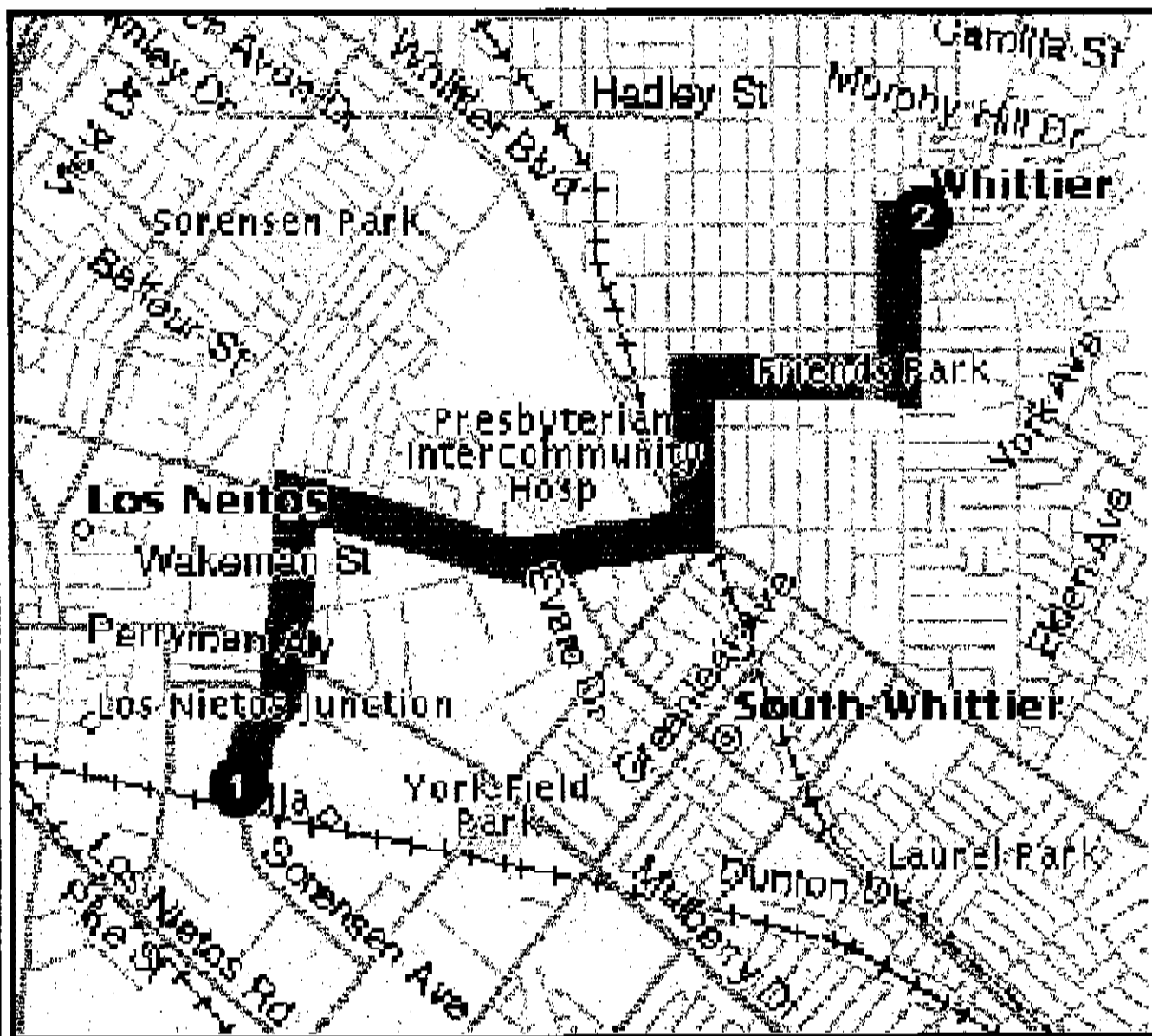
All HASPs prepared by Blakely Environmental Investigations, Inc. subcontractors will be added as addenda to this HASP as applicable.

Heavy Equipment

Truck-mounted drilling equipment and support trucks are the expected types of heavy equipment that will be used during field activities. Heavy equipment can represent a substantial hazard to workers. In general, requirements for motor vehicles and material handling equipment are provided in the OSHA Construction Industry Standards 29 CFR 1926, Subpart O, and 8 CCR, Div. 1, Ch. 4, Subchapter 4. The following Standard Operating Procedures (SOPs) are to be followed when heavy equipment is in use:

- ◆ Use common **sense**. Do not assume that the equipment operator is keeping track of your whereabouts. Never walk directly in back of or to the side of, heavy equipment without the operator's knowledge;
- ◆ Hard hats and steel toe boots are to be worn at all times around heavy equipment. Other protective gear as specified in the health and safety plan is also applicable;
- ◆ All heavy equipment must be shut down during refueling;
- ◆ Remain alert at all times;
- ◆ Maintain visual contact of moving equipment at all times;
- ◆ Establish hand signal communication when verbal communication is difficult. Determine one person per work group to give hand signals to equipment operators;
- ◆ Be aware of footing at all times;

- ◆ All heavy equipment shall have backup alarms of some type;
- ◆ Only qualified/licensed people are to operate heavy equipment;
- ◆ Use chains, hoist, straps, and any other equipment to safely aid in moving heavy materials;
- ◆ Use proper personal lifting techniques. Use your legs, not your back when lifting;
- ◆ Never use a piece of equipment unless you are familiar with its operation. This applies to heavy as well as light equipment (i.e., steam cleaners, hand tools, etc.);
- ◆ Be sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines, will present a hazard in the work area;
- ◆ Keep all non-essential people out of the work area;
- ◆ Prohibit loose-fitting clothing or loose long hair around moving machinery;
- ◆ Keep cabs free of all non-essential items and secure all loose items;
- ◆ Instruct equipment operators to report to their supervisor(s) any abnormalities such as equipment failures, oozing liquids, unusual odors, etc.;
- ◆ When an equipment operator must negotiate in tight quarters, provide a second person to ensure adequate clearance;
- ◆ Implement an ongoing maintenance program for all tools and equipment. Inspect all tools and moving equipment regularly to ensure that parts are secured and intact with no evidence of cracks or areas of weakness, that the equipment turns smoothly with no evidence of wobble, and that it is operating according to manufacturer's specifications. Promptly repair or replace any defective items. Keep maintenance and repair logs;
- ◆ Store tools in clean, secure areas so that they will not be damaged, lost or stolen;
- ◆ Keep all heavy equipment that is used in the exclusion zone until the job is done. Completely decontaminate equipment within the designated vehicle decontamination pad;
- ◆ Drill masts must be fully lowered when not in use;
- ◆ Parking brakes shall be engaged when equipment is not in use;
- ◆ With certain exceptions, all material handling equipment will be provided with rollover protective structures;
- ◆ Equipment with an obstructed rear view must have an audible alarm that sounds when it is operating in the reverse direction (unless a spotter guides the vehicle operator);
- ◆ All heavy equipment must properly leveled, supported, and occurred prior to use;
- ◆ A safety barrier will be used to protect workers whenever tires are inflated, removed, or installed on split rims;
- ◆ Heavy equipment will be inspected by the operator prior to the beginning of each work shift, and the HASM shall ensure the compliance to this regulation;
- ◆ Heavy equipment and trucks will be operated in specific site control zones and marked traffic lanes;
- ◆ All appropriate agencies will be notified prior to initiating drilling activities; and
- ◆ Operator will obey all posted traffic control rules and signs.



Blakely Environmental
Investigations, Inc.
P.O. Box 339
Wrightwood, CA 92397

Hospital Route

Angeles Chemical Company
8915 Sorensen Avenue
Santa Fe Springs, CA

Figure 1

Field Team Review and Emergency Data

I have read and reviewed the most recent revision _____
Date

of the Health and Safety Plan (HASP) for the _____
Project

_____. I understand the information contained therein and will
Site

comply with all aspects of the HASP.

Name: _____

Signature: _____

Date: _____

This information is in case of emergency only:

Social Security #: _____

Person(s) to notify in case of Emergency:

Relationship: _____

Daytime Phone #: _____

Name of Physician: _____ Phone #: _____

Medical Coverage: _____

Employee Date of Birth: _____

*Known Allergies: _____

*Known Medical Conditions: _____

*any known allergies or medical conditions that physicians should be made aware of before medical attention is given (i.e. allergic to penicillin).

TAILGATE SAFETY MEETING

Facility _____
Time _____ Job Number _____
Address _____
Specific Location _____
Type of Work _____
Chemicals Used _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____
Chemical Hazards _____
Physical Hazards _____
Emergency Procedures _____
Hospital/Clinic _____ Phone () _____ Paramedic Phone () _____
Hospital Address _____
Special Equipment _____
Other _____

ATTENDEES

NAME (printed)

SIGNATURE

NAME (printed)	SIGNATURE
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted By _____
Supervisor _____ Manager _____

ANINS000101

APPENDIX B

**Mobile Laboratory
Standard Operating Procedure
Volatile Organic Compounds by Gas Chromatography/
Mass Spectrometry (GC/MS)**

EPA Method 8260b

1. SCOPE AND APPLICATION

- 1.1 EPA Method 5030A/8260B is conducted in mobile laboratory using a Telmer LCS 2000 purge and trap (P/T) (equipped with an ALS 2016 autosampler), a Hewlett Packard (HP) 5890 Series II gas chromatograph (GC), a HP mass selective detector (MSD) and computer.
- 1.2 This method can be applied to water, soil and vapor and is based on 5 g or 5 ml of sample.
- 1.3 The following compounds are determined by this method:

Target Analytes			
Dichlorodifluoromethane	1,2-Dibromomethane	2-Butanone	4-Chlorophenanthrene
Chloromethane (SP)	4-Methyl-2-Pentanone	1,1,1-Trichloroethane	p-Isopropyltoluene
Vinyl Chloride (CC)	1,2-Dichloropropane	1,1-Dichloropropene	Isopropyl benzene
Bromomethane	Tetrachloroethene	Carbon Tetrachloride	1,3,5-Trimethylbenzene
Chloroethane	Dibromochloromethane	1,2-Dichloroethane	sec-Butylbenzene
Trichlorofluoromethane	Chlorobenzene (SP)	Benzene	tert-Butylbenzene
Freon 113	Ethylbenzene (CC)	Trichloroethane	1,3-Dichlorobenzene
1,1-Dichloroethane (CC)	1,1,1,2-Tetrachloroethane	1,2-Dichloropropane (CC)	1,4-Dichlorobenzene
Methylene Chloride	2-Hexanone	Bromodichloromethane	n-Butylbenzene
Acetone	m,p-xylenes	Dibromomethane	1,2-Dichlorobenzene
Carbon Disulfide	o-xylene	trans-1,3-Dichloropropene	1,2-Bis-3-Cl-Propene
MtBE	Styrene	Toluene (CC)	1,2,4-Trichlorobenzene
Cis-1,2-Dichloroethane	Bromoform (SP)	cis-1,3-Dichloropropene	Hexachlorobutadiene
1,1-Dichloroethane (SP)	1,1,2,2-Tetrachloroethane (SP)	n-Propylbenzene	Naphthalene
2,2-Dichloropropane	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,2,3-Trichlorobenzene
Trans-1,2-Dichloroethane	Chloroform (CC)	Bromobenzene	
1,1,2-Trichloroethane	Bromochloromethane	2-Chlorotoluene	
Internal Standards		Additional Compounds	
Pentafluorobenzene	Surrogate Standards	TBA	
1,4-Difluorobenzene	Dibromofluoromethane	DIPE	
Chlorobenzene-d5	Toluene-d8	ETBE	
1,4-Dichlorobenzene-d4	Bromofluorobenzene	TAME	

2. GENERAL SUMMARY OF METHOD

- 2.1 The volatile compounds are introduced into the GC by the P/T method. The components are separated via the gas chromatograph and detected using a MSD, which is used to provide both qualitative and quantitative information. The P/T parameters, chromatographic conditions, and MSD operating parameters will be given in Section 4.0 of this SOP.
- 2.2 The P/T process: An inert gas is bubbled through the sample matrix efficiently driving the volatile components to the vapor phase. The vapor is swept through a sorbent column where the

- volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with an inert gas to desorb the components onto a chromatographic column.
- 2.3 Separation of the vaporized sample into individual components is accomplished using the GC. By choosing the proper chromatographic column and optimizing GC parameters such as temperature, rate of temperature increase and time, each compound will be uniquely retained as it elutes through the column.
- 2.4 Upon exiting the column, each compound travels into the MSD. The MSD electronically responds to the arriving analytes and by means of comparison with commercially available standards, identification and quantitation is accomplished.

3. INTERFERENCES

- 3.1. Cross-contamination (carryover) can occur whenever high-level and low-level samples are analyzed sequentially. Whenever an unusually concentrated sample is analyzed, it should be followed by the analysis of method blank to check for carryover. The P/T and GC/MS systems may require extensive bake-out and cleaning after a high-level sample.
- 3.2. Impurities in the purge gas and from organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running lab reagent blanks. The use of non-TFE plastic coating, non-TFE thread sealants, or flow controllers with rubber components in the purging device should be avoided.
- 3.3. The mobile laboratory, when possible, should be completely free of solvents. Commonly used solvents, which may pose a problem, include methylene chloride, Freon 113, acetone and hexane.

4. INSTRUMENT

4.1 PURGE AND TRAP

- 4.1.1 The P/T method of separation basically consists of three steps: purging, desorbing and baking. In the mobile lab a Tekmar LCS 2000 equipped with an ALS 2016 is used. Inside the LCS 2000, a Vocab 3000 Trap K (Supelco Cat #2-1066) should be installed. One can follow the specific instructions included with the trap when installing, while keeping these suggestions in mind: Use the appropriate Teflon or graphite ferrule; Do not over-tighten fittings (1/4 wrench turn past finger tight); Ensure that there is flow through the trap prior to conditioning by initiating a purge cycle (see 4.1.2 and 4.1.3 for operation of P/T system). Using a bubble flowmeter and the timer function on the GC, measure the flow exiting the vent on the front of the LCS 2000. This flow should be approx. 40 ml/minute. (Ensure while measuring the flow that a sample tube is in place at the appropriate station of the ALS 2016).

4.1.2 P/T METHOD PARAMETERS

Initial Temperature - 35°C

Purge Time - 11 minutes.

Dry Purge - 2 minutes (can vary depending on performance).

Desorb Preheat - 245°C.

Desorb Temperature and Time - 250°C for 3 minutes.

(Time can vary depending on performance)

Bake Temperature and Time - 260°C for 10 minutes.

All line temperatures should be 110°C.

Autodrain and BGB should be off.

Purge pressure (gauge; front, bottom, right LCS 2000) - 20 psi

Flows measured at the LCS 2000 vent while in Purge, Dry Purge, and Bake modes should all be approx. 40 ml/minute.

Those parameters can be entered into the P/T by selecting METHOD (F1) from the Purge Ready screen, then selecting Method 1, then EDIT (F3). After entering the above select EXIT (F4).

4.1.3 P/T SEQUENCE

Once a Method is created, the next action is to create a sequence for the ALS 2016. This is done, by choosing ALS (F2) from the Purge Ready screen. At this point the number of the station you wish to start from and finish on is entered. To initiate the sequence, EXIT (F4) to the Purge Ready screen, and press START. While in the ALS screen there is a function called SCHEDULE (F2). This function can be enabled permitting the sequence to skip certain stations on the ALS 2016. To enable, press the "Y" on the LCS 2000 keypad.

4.1.4 MORE INFO

For a more detailed description of how the LCS 2000 and ALS 2016 function and can be programmed see the Tekmar operating manuals that are located in the mobile lab or in the in-house, volatile section.

4.2 GAS CHROMATOGRAPH

4.2.1 In the mobile lab, a HP 5890 series II GC is used. The GC is equipped with a split/splitless injection port and Electronic Pressure Control (EPC). A commercially made capillary column designed to separate volatile compounds is directly attached from the injection port to the MSD. Within the GC there should be all the necessary components such as inlet septa, liner, liner o-ring, seal and all appropriate ferrules. See SOP - "Mobile Lab Supplies".

4.2.2 COLUMN

J&W Scientific - DB-VRX 60m, 0.25mm I.D., 1.4um film thickness (cat.# 122-1364)

Temperature range: -10°C to 260°C.

4.2.3 TEMPERATURE SETTINGS/PROGRAM/FLOWS

Zone Temperatures:

Injection Port Temperature - 220°C

Detector B Temperature - 250°C

Temperature Program:

Initial Temperature - 45°C

Initial Time - 5 minutes

Rate - 10°C/minute.

Final Temperature - 100°C

Final Time - 0 minutes.

Rate A - 20°C/minute.

Final Temperature A - 250°C

Final Time A - 7 minutes.

Flows:

Column Head Pressure (EPC) - approx. 12-16psi
(adjust for desired flow through column)

Total Flow - approx. 12 ml/min.

(measured at vent on front, bottom, left GC; adjust for desired split ratio)

Note: Increasing flow at vent increases the amount of sample being directed away from the column.

4.2.4 MORE INFO

For a more detailed description of how the HP 5890 functions refer to HP 5890 operating manuals which are located in the mobile lab or in the in-house, volatile section.

4.3 MASS SPECTROMETER

4.3.1 A HP 5971 or a 5972 MSD is used in the mobile lab. It is directly connected with the GC via the GC/MS interface. The capillary column runs through this heated interface into the MSD source.

4.3.2 To adjust the MSD operating parameters a "hardware tune" should be performed. Tune programs within the instrument software permit the user to automatically adjust and optimize all MSD operating parameters instead of having to adjust them manually. The programs that should be run are Standard Spectra Autotune followed by BFB Target Tune. When the instrument is functioning well, these software tunes will satisfy Section 4.3.3.

4.3.3 The MSD parameters should be such that when 50 ng of 4-bromofluorobenzene (BFB) is injected or purged into the GC/MS system the resulting mass spectrum meets all the criteria listed below:

<u>Ion</u>	<u>Required Intensity (relative abundance)</u>
50	5% to 40% of ion 95
75	30% to 66% of ion 95
95	Base Peak, 100%
96	5% to 9% of ion 95
173	0% to 2% of ion 174
174	50% to 120% of ion 95
175	5% to 9% of ion 174
176	93% to 101% of ion 174
177	5% to 9% of ion 176

The above criteria is from CLP. Other protocols may be substituted (e.g. Method 524.2, 8260B or the manufacturer's instructions provided that the methods performance is not compromised)

4.3.4 MORE INFO

For a more detailed description of the theory of MS function and how to maintain the HP 5971/5972 refer to HP 5971/5972 hardware manuals which are located in the mobile lab or in the in-house, volatile section.

4.4 DATA SYSTEM

4.4.1 A computer with 486 processing and dual gigabyte hard drives is used to operate the GC/MS instrument. HP MS DOS Chemstation, Enviroquant and NBS75K Library are Windows based software packages used to acquire and reduce analytical data. MS DOS Chemstation is the underlying software that controls the instrument with Enviroquant acting as kind of overlying shell that enhances data reduction capabilities. NBS75K is a large library of mass spectra that is accessed in Enviroquant to aide in compound identification.

4.4.2 DATA STORAGE

As the system acquires and stores data, the hard drives inevitably become full. When this happens, the data system is linked with the in-house network and the data is downloaded and subsequently archived on CD.

4.4.3 MORE INFO

Instructions on how to use Enviroquant to run the instrument and manipulate the acquired data can be found in the Enviroquant User's Guide located in the in-house, volatile section.

5. ADDITIONAL EQUIPMENT/REAGENTS

5.1 This equipment is obtained from the stationary lab or ordered for the mobile laboratory specifically. See SOP - "Mobile Lab Supplies".

5.2 Syringes - Two 5.0 ml, 1.0 ml, 250 ul, 50 ul syringes and five 10 ul syringes. Used for sample and standard preparation.

5.3 Reagent grade methanol (MeOH) B&J (cat.# 232-235, 235ml). Used for standard preparation and soil extractions.

5.4 Class A Volumetric Flasks - 2 ml, 10 ml and 100 ml. Used for standard preparation. Organic free water. Carbon filtered or helium purged water obtained from stationary lab. Bottled water can be used as long a blank is run demonstrating that it is non-detect for all target analytes.

5.5 Amber vials/Screw-caps - 2 ml, 4 ml and 14 ml. Used for standard preparation and soil extractions.

5.6 Valves with septa for 4 ml vials.

5.7 Balance - Capable of 0.1 g.

5.8 Beakers - 200 ml and 500 ml.

5.9 Spatula - Stainless steel.

5.10 Sample Tubes (P/T) - 5 ml analysis - 150mm by 19mm.

5.11 Pasteur pipettes/Bulb - 5 ml and 9 ml, glass.

5.12 Disposable pipettes/Bulb - 10 ml, glass.

6. STANDARDS

6.1 Working standard stock solutions should be stored with minimal headspace and should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration runs from them. Standards are stored in amber vials at -10°C or less. Standards

should be returned to the freezer as soon as possible. Standards should be replaced when data warrants. Follow all manufacturer's expiration dates. All documents regarding the certification of standards is filed with the QC officer.

- 6.2 All syringes and glassware used in standard preparation are dedicated for this purpose.
- 6.3 Internal Standards (IS) - This method uses internal standard quantitation. Internal standards are used to monitor and adjust for instrument fluctuations. Pentafluorobenzene, 1,4-difluorobenzene, 1,4-dichlorobenzene-d4 and chlorobenzene-d5 are used in the mobile lab.
- Surrogate Standards (SS) - Surrogates monitor the instrument's performance. Toluene-d8, 4-bromofluorobenzene and dibromofluorobenzene are the surrogates used in the mobile lab.

6.3.1 Preparation IS/SS

A 125 ug/l IS/SS solution in MeOH is prepared by diluting the high stock solutions. Fill a cleaned, 10 ml volumetric flask with approx. 8 ml MeOH. Using a 1.0 ml and 50ul syringes, transfer 625 ul of each high stock solution to the flask making sure to inject into the body of MeOH. Fill volumetric to volume and invert no more than three times. Transfer contents using a 9 ml Pasteur pipette to labeled 4 ml amber vials. Use valves with septa to cap.

- 6.4 Bromofluorobenzene standard (BFB) - BFB is injected or purged through the GC/MS system in order to monitor the MSD electronics. This is done by, evaluating the resulting mass spectra and insuring that it meets the criteria given in Section 4.3.3.

6.4.1 Preparation BFB

A working standard solution containing 25 ug/ml of BFB in methanol is prepared by diluting the high stock solution. Fill a cleaned, 10 ml volumetric flask with approx. 9.5 ml MeOH. Using a 250ul syringe, transfer 100 ul of high stock solution to the flask making sure to inject into the body of MeOH (Transfer any remaining BFB in the ampul to a labeled 2 ml amber vial and cap). Fill volumetric to volume and invert no more than three times. Transfer contents using a 9 ml Pasteur pipette to labeled 4 ml amber vials. Use valves with septa to cap.

- 6.5 Matrix Spike (MS) and Laboratory Control Sample (LCS) standards - MS and LCS standards/samples are used to gauge the method's ability of extracting target analytes from the sample matrix. The analytes found in these standards are: 1,1-dichloroethene, trichloroethene, chlorobenzene, toluene and benzene.

6.5.1 Preparation MS

A working standard solution containing 50 ug/ml of MS compounds in methanol is prepared by diluting the high stock solution. Fill a cleaned, 2 ml volumetric flask with approx. 1.5 ml MeOH. Using a 500 ul syringe, transfer 400 ul of high stock solution to the flask making sure to inject into the body of MeOH (Transfer any remaining solution in the ampul to a labeled 2 ml amber vial and cap). Fill volumetric to volume and invert no more than three times. Transfer contents using a 9 ml Pasteur pipette to a labeled 2 ml amber vial.

- 6.6 Certified standard solutions or high stock solutions should be obtained from commercial vendors such as Absolute, EM Science, ChemService, Restek and Supelco. These concentrated solutions can then be diluted to make working stock solutions. For target analytes, there must be two working stock solutions prepared from different manufacturers or lot numbers in order to confirm the accuracy of the solutions. For all standards used in the mobile lab see SOP - "Mobile Lab Standards"

- 6.6.1 Calibration standards - There are two types of calibration standards used for this method: Initial calibration standards (ICAL standards) and initial calibration verification standards (ICV/CCV). These standards differ by manufacturers or lot numbers. The ICAL standards are used to run a calibration curve (ICAL) of at least five different concentrations. This curve is then verified using the ICV/CCV standards run at approximately the midpoint of the ICAL. Once verified, either standard can be used as the continuing calibration standard (CCV). The CCV is run at approximately the midpoint of the ICAL during every 12 hours of sample analysis.

Preparation of both types of standards is identical. Where the high stock solutions are at different concentration then, obviously, different volumes must be used.

6.6.1.1 Preparation - Gas Mix

A working standard solution containing 50 µg/ml of target analytes in methanol is prepared by diluting the high stock solutions. Using a 1.0 ml syringe add 2.6 ml of MeOH to a labeled 4 ml amber vial. Using a 250 µl syringe, add 100 µl of the ketone mix, 100 µl of MTBE and 200 µl of Freon 113. (Transfer any remaining solutions in the ampuls to labeled 2 ml amber vials and cap). Using a 1.0 ml syringe add 1.0 ml of the 5 component gas mixture to the vial. Make sure to inject into the body of MeOH.

6.6.1.2 Preparation - Mix

A working standard solution containing 50 µg/ml of target analytes in methanol is prepared by diluting the high stock solution. Using a 1.0 ml syringe add 3.0 ml of MeOH to a labeled 4 ml amber vial. Using a 1.0 ml syringe, add 1.0 ml of the 54 component mix to the vial. Make sure to inject into the body of MeOH.

6.7 STANDARDS LOG BOOK

When standards are prepared, information about their preparation must be entered into the mobile lab Standards Log Book. See SOP - Standards Log Book.

7. PROCEDURE

This SOP assumes that MS Chemstation and Enviroquant is loaded and configured properly and has been launched - This includes the creation of a method within the software.

- 7.1 BFB - The GC/MS system must be hardware tuned. See Section 4.3.2. STANDARD SPECTRA AUTOTUNE can be found by choosing MANUAL TUNE from the TUNEMS menu selection then selecting TUNE. Once the tune is complete save the results in ATUNE.U and exit. To run a BFB Target Tune, select TUNEMS, TARGET and then BFB TUNE. Once the tune is complete save the results in BFB.U and exit.

- 7.1.1 To check that the hardware tune was successful and that the system is adequately sensitive, 2µl of the BFB standard is purged or injected into the system. To do this or any analysis, a sequence must be set up in Enviroquant. See SOP - VOA Sequence Setup. The resulting mass spectra of the BFB must satisfy the criteria given in Section 4.3.3. The mass spectra can be evaluated using the Tuner Function within Enviroquant. Analysis must not begin until a purged or injected BFB sample can meet these criteria.

7.1.2 When reviewing the BFB spectra for a passing scan, the following rules must be considered: If background subtraction is required, it must be done using a single scan no more than 20 scans on either side of the BFB peak. Do not background subtract any part of the BFB peak.

7.1.3 All subsequent standards, samples, MS/LCS's and blanks associated with a BFB analysis must use identical MSD instrument conditions.

7.2 ICAL - An ICAL of at least 5 different concentrations must be run. This is done by spiking 5 ml of organic-free reagent water with the IS/SS, Gas Mix and Mix standards.

7.2.1 All samples are spiked at 10ug/ml of IS/SS (except BFB samples). This corresponds to a 2ul spike amount into 5 ml.

7.2.2 The levels usually used in the mobile lab are 5, 20, 40, 50, 100, 150 and 200ug/ml. This corresponds to 0.5, 2.0, 4.0, 5.0, 10, 15 and 20ul of the Gas Mix and Mix solutions. Each standard is prepared individually in a 5.0 ml syringe and then placed on the P/T for analysis.

7.2.3 Using Enviroquant, each standard run should be reviewed to ensure the software has properly integrated and identified all compounds.

7.2.4 Using the Enviroquant, update the software method with the standard data files and tabulate the area response of the characteristic ions against concentration for each compound and each internal standard. Using Enviroquant calculate response factors (RF) for each compound relative to one of the internal standards. The internal standard selected for the calculation of the RF for a compound should be the internal standard that has a retention time closest to the compound being measured. The RF is calculated as follows:

$$RF = (Ax/Cis)/(Ais/Cx)$$

where:

Ax = area of the quantitation ion for the compound being measured.

Ais = area of the quantitation ion for the specific internal standard.

Cis = concentration of the specific internal standard.

Cx = concentration of the compound being measured.

7.2.5 System Performance Check Compounds (SPCC's) - The mean RF must be checked for the following compounds and must satisfy the criteria given in order for the ICAL to be valid:

Chloromethane - 0.10

1,1-Dichloroethane - 0.10

Bromoform - 0.10

Chlorobenzene - 0.30

1,1,2,2-Tetrachloroethane - 0.30

7.2.6 Calibration Check Compounds (CCC's) - The purpose of the CCC's are to evaluate the integrity of the ICAL. Meeting the CCC criteria is not a substitute for successful calibration of the target analytes.

7.2.7 The Relative Standard Deviation (RSD) must be checked for all compounds.

$$RSD = SD / RF_{ave} \cdot 100$$

where:

SD = standard deviation of RF's for each compound of the ICAL

RF_{ave} = mean RF for each compound of the ICAL.

The RSD should be less than or equal to 15% for each target analyte. However, the RSD for each individual CCC must be equal to or less than 30%. The CCC's are:

1,1-Dichloroethene
Chloroform
1,2-Dichloropropane
Toluene
Ethylbenzene
Vinyl Chloride

7.2.8 If any CC is above 30% then the ICAL is not valid and corrective action must be taken. Corrective action may include rerunning one of the standards, checking integration and identification and/or decreasing the range of the ICAL to eliminate saturation.

7.2.9 The ICAL for all target analytes should have an RSD of less than or equal to 15%. If the ICAL contains compounds that exhibit average RSD's greater than 15% then one of two actions can be followed:

1) Analyze the points of the ICAL. If necessary, eliminate one of the points or rerun a problematic point.

2) The average RF RSD of all target compounds and surrogates can be calculated. If this total average RF RSD is less than 15% then the ICAL is valid.

NOTE: If a target analyte has a RSD that is beyond 15% and a reportable amount is detected, then that sample must be run under valid conditions for that particular analyte.

7.2.10 Evaluation of Retention Times - The relative retention times of each target analyte in each calibration standard should agree within 0.06 minutes.

7.2.11 Once all of the above criteria are met then the ICAL is considered linear and valid. The software method with the updated ICAL should be saved.

7.2.12 Average response factors are used for quantitation.

7.3 CALIBRATION VERIFICATION (ICV/CCV)

Calibration verification consists of three steps that are performed at the beginning of each 12-hour analytical shift.

7.3.1 A BFB sample that meets the given criteria.

7.3.2 The ICAL for each target analyte of interest should be verified by running a ICV/CCV at or about the mid-point of the ICAL. In the mobile lab the ICV/CCV is usually 50 ug/ml.

7.3.3 A method blank should be analyzed after the ICV/CCV to ensure that the total system (P/T, transfer lines and GC/MS) is free of contaminants.

7.3.4 SPCC for ICV/CCV's - Each SPCC compound in the ICV/CCV must meet its minimum RF given in Section 7.2.3. If the minimum RF for any SPCC is not met then corrective action must be taken. Corrective action includes making new ICV/CCV standard, injection port maintenance and/or deactivation of possible active sites in system.

7.3.5 CCC for ICV/CCV's - Each CCC compound in the ICV/CCV when compared to the ICAL must have a percent difference of less than or equal to 20%.

7.3.6 The ICV/CCV for all target analytes should be less than or equal to 20%. If the ICV/CCV contains compounds that exhibit RF differences greater than 20% relative to the ICAL then the following can be done:

1) Reanalyze the ICV/CCV.

2) The average RF deviation of all target compounds and surrogates can be calculated. If this total RF deviation is less than 20% then the ICAL is still valid.

NOTE: If a target analyte has a RF difference that is beyond 20% and a reportable amount is detected, then that sample must be run under valid conditions for that particular analyte.

7.3.7 Internal Standard Retention Time - The retention times of the internal standards in the ICV/CCV cannot deviate by more than 30 seconds from the mid-point standard of the most recent ICAL.

7.3.8 Internal Standard Response - The area for any of the internal standards in the ICV/CCV must not change by more than a factor of two (-50% to +100%) from the mid-point standard of the most recent ICAL.

7.4 All of the above calculations and evaluations can be done using Enviroquant.

7.5 ANALYSIS OF SAMPLES

7.5.1 All samples and standard solutions must be allowed warm to ambient temperature before analysis.

7.5.2 Water Samples - Open the sample container and carefully draw the sample into the syringe barrel to just over the 5 ml mark and discharge as waste. Repeat this procedure to properly rinse the syringe. On the third draw discharge the residual air while adjusting the sample volume to 5.0 ml. Add the 2 ul of IS/SS standard to syringe with water sample. Place into purge tube on P/T autosampler. Tighten fitting with wrench.

7.5.3 Soil Samples - Draw up organic free reagent water into the syringe barrel to just over the 5 ml mark and discharge the residual air while adjusting the volume to 5.0 ml. Add the 2 ul of IS/SS standard to syringe. Weigh out 5 gm of sample into the purge tube. Quickly, add syringe contents to soil sample in the tube and place on P/T autosampler. Tighten fitting with wrench.

7.5.4 Program a sequence into the P/T and computer. Download the sequence to the instrument. Initiate a the purge cycle.

7.5.5 If the initial analysis of a sample has a concentration of target analyte(s) that exceeds the ICAL upper range, the sample must be reanalyzed at a dilution. When a sample is analyzed that has saturated ions from a compound, this run must be followed by a blank reagent water analysis. If the blank analysis is not free of interferences, the system must be decontaminated. Sample analysis may not resume until a blank can be analyzed that is free of interferences. Past data regarding carryover can be used to determine at what level a particular compound will exhibit system carryover.

7.5.6 Secondary ion quantitation is allowed only when there are sample interferences with the primary ion.

7.5.7 Once an aliquot has been taken from a water sample, the remaining volume in the VOA vial is considered invalid. If reruns or dilutions are required, a second vial is needed.

7.5.8 Dilutions for Water Samples - Dilutions should be done using volumetric flasks. The appropriate volume of sample should added to the appropriate flask using a syringe. The volumes, of course, depend on the level of dilution necessary. Volumes of less than 1 ml of sample are not recommended.

7.5.9 Dilutions for Soil Samples - Place 4 g of the sample into a 14 ml amber vial. Add 10 ml MeOH to vial, cap and shake out for approx. 5 minutes. Using a syringe, take the appropriate volume of the resulting extract and inject into a purge tube containing 5 ml reagent water spiked with IS/SS.

7.5.10 All dilutions should keep the response of the major constituents (previously saturated peaks) in the upper half of the linear range of the curve.

7.5.11 Qualitative Analysis (Identification) - The qualitative identification of each compound determined by this method is based on retention time, and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by the laboratory using the conditions of this method. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

Enviroquant is setup to use one to three ions from the mass scan and best retention time to base it's quantitation and identification process. The ion of greatest intensity is generally used as the quantitating ion with one to two ions of lesser intensity used as qualifier ion(s). It is these qualifier ions that are used for identification.

Compounds are identified as present when the following criteria are met.

1) The intensities of the characteristic ions of a compound maximize in the same scan or within ones-scan of each other. Selection of a peak by a data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion.

Enviroquant utilizes a large database of environmental compound mass spectra. This database can easily be searched to find a match for the sample mass spectra.

2) The relative retention time (RRT) of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

3) The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

4) Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

5) Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.

7.5.12 Tentatively Identified Compounds (TICS) - Use the following guidelines for TICS:

1) Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

2) The relative intensities of the major ions should agree within $\pm 20\%$. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%).

3) Molecular ions present in the reference spectrum should be present in the sample spectrum.

4) Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

5) Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks. Data system library reduction programs can sometimes create these discrepancies.

7.5.12.1 Where applicable, the concentration of a TIC should be estimated. The formula given in Section 7.5.13 should be used with the following modifications: The areas A_x and A_{is} should be from the total ion chromatograms and the RF for the compound should be assumed to be 1.

7.5.12.2 The resulting concentration should be reported indicating: 1) that the value is an estimate, and 2) which internal standard was used to determine concentration. Use the nearest internal standard free of interferences.

7.5.13 Quantitative Analysis - Concentration of target analytes can be calculated by using the following equation: (Enviroquant is setup to calculate concentration in ug/l).

$$\text{Concentration (ug/l)} = \frac{A_x \cdot C_{is}}{A_{is} \cdot Rf_{ave}} \cdot DF$$

where:

A_x = area of the quantitation ion for the compound being measured.

A_{is} = area of the quantitation ion for the specific internal standard.

C_{is} = concentration of the specific internal standard.

Rf_{ave} = Average response factor for target analyte

DF = Dilution Factor (if any).

8. QUALITY CONTROL

8.1 The mobile laboratory must maintain records to document the quality of the data generated: See SOP Daily Field Responsibilities.

8.2 The GC/MS system must be tuned to meet BFB specifications in Section 4.3.3.

8.3 An ICAL must be run and satisfy the criteria in Section 7.2.

8.4 Each 12 hours of work the instrument is verified as valid as given in Section 7.3.

8.5 For each batch of 20 samples, a matrix spike and duplicate (MS/MSD) along with a laboratory control sample (LCS) must be run. This applies to each type of matrix. For example, water and soil being analyzed during the same analytical session would require a MS/MSD and LCS for soil and another set for the water.

8.6 MS/MSD and LCS samples are prepared at 20 ug/ml using the solution described in Section 6.5.1.

8.7 Acceptance criteria of 70-130% is used for LCS's and surrogate recoveries.

8.8 Acceptance criteria of 25% is used for MS/MSD relative percent difference (RPD).

8.9 After the following changes to a system, a new ICAL is mandatory regardless of the ability to pass a CCV: changing or reversing the column; changing PID seal or lamp; changing FID jet; changing the entrance lens, draw out lens, or repeller; cleaning the MS source; changing the electron multiplier, ion source chamber, or injector port.

8.10 A method detection limit study (MDL) should be performed at a minimum of every 6 months or whenever there are significant instrument modifications. A MDL is defined as the minimum concentration of substance that can be measured and reported with 99% confidence that the value is above zero.

8.11 MDL's should be run at a concentration 3-5 times the expected detection limit. For example, if the expected detection limit (DL) is 0.25 ug/l then the spiked concentration should be about 1.0 ug/l.

8.12 Seven replicates should be run at the appropriate concentration. The following can be used to calculate the detection limit:

$$MDL = SD * 3.143$$

where:

SD = Standard deviation of seven replicate concentrations.

3.143 = t value (statistical number based on number replicates.)

8.13 The reporting limit (RL) should greater than the DL.

9. REFERENCES

"Method 8260B-Volatile Compounds," Test Methods for Evaluating Solid Wastes, 3rd Ed. (Update 3), United States Environmental Protection Agency, Washington, DC, 20460, 1996.

Soil Gas Procedures

1) Sampling

- A) Vapor samples are collected into glass sample bulbs. The sample bulbs are equipped with septa that permit sub-sampling using glass syringes.
- B) Once the sampling point is established (i.e. nested probes), the sample bulb is placed in line prior to the sampling pump using the appropriate tubing.
- C) A site-specific purge volume test should be conducted in order to determine the optimum volume to purge from the sampling point prior to sample collection. (See purge volume section below).
- D) The sample is then taken by first closing the sample bulb stopcock nearest the pump then closing the remaining stopcock.
- E) The sample bulb is then taken to the laboratory and immediately sub-sampled using a glass syringe fitted with a valve.
- F) An aliquot of 5 milliliters (ml) is drawn into the syringe and introduced into the purge and trap autosampler.
- G) The sample bulb is held until satisfactory analytical results are obtained.
- H) A hold time of 4 hours has been established for sampling bulbs.
- I) If necessary, another aliquot can be taken from the bulb within 4 hours of collection. Cases that warrant additional sub-sampling include dilutions, equipment failure and/or QC failure.
- J) Every effort is made to expedite satisfactory analytical results in order to minimize sample holding time. Beyond 4 hours, the sample is considered suspect.

2) Analysis

- A) 5 ml of reagent water containing the surrogate/internal standard (IS/SS) mix is placed into the purge and trap autosampler.
- B) Five ml of sample is placed into the purge and trap autosampler.
- C) The sample is purged for 11 minutes.
- D) The trap is dry purged for 2 minutes.
- E) The trap is desorbed to the gas chromatograph for 3 minutes at 250°C.
- F) The trap is then cleaned by baking for 11 minutes at 260°C.
- G) The sample is analyzed on the GCMS as per EPA method 8260B.

3) Quality Control

- A) The GCMS must be within tune specs using bromofluorobenzene (BFB) as per EPA method 8260B.
- B) Initial Calibration curve (ICAL).
 - i) The GCMS must be tuned in accordance to EPA method 8260.
 - ii) The calibration must contain all LARWQCB compounds and any other requested target compounds.
 - iii) The calibration must contain at least 5 points with one point no higher than 5 times the Reporting Limit (RL).
 - iv) The percent relative standard deviations for the response factors (RFs) calculated from each point of the ICAL must not exceed 20% except for the volatile gases and freons, which must not exceed 30%.
 - v) The ICAL must be verified with an independent standard (called a LCS). The RFs from the LCS must be within 15% of the ICAL, except for the volatile gases and freons, which must not exceed 25%.
- C) Continuing Calibration Verification (CCV) / Daily calibration.
 - i) The instrument must be shown to be in calibration daily by the analysis of a standard that approximates the mid-point of the ICAL. The RF's must be within 25% of the ICAL.

- D) An ambient air blank is analyzed. No target analyte should be detected above the RL.
- E) At the end of the day a LCS must be run. The type of LCS depends of the following:
 - i) If no compounds were detected a LCS must be run at the detection limit. The RFs must be within 50% of the ICAL RFs.
 - ii) Otherwise another midpoint LCS should be run. The RFs must be within 20% of the ICAL RFs, except for the volatile gases and freons, which must be within 30%.
- F) Surrogates
 - i) Surrogates are added to all samples. Surrogate %R's must be within 70-130%.

4) Purge/Volume

- A) The optimum volume is that, which yields the highest target compound concentration.
- B) The purge volume is directly related to the amount of time that the sample point is connected to a vacuum pump.
- C) The flow rate of the pump should be approximately 200 ml/min but could be increased to expedite sampling, especially for large diameter or deep sample points.
- D) By calculating the volume of the sampling point and by using the known volume of the bulb and the known flow rate, the amount of time that the sampling point is to be purged can be determined.
- E) For example: 2 volumes are to be purged from a point that is 40 feet deep and uses 1/4 inch I.D. Teflon tubing. The sample is to be collected into a 250 ml sample bulb. The flow rate that the pump is set to is 200 ml/min. Calculate the amount of time that the point is to be purged in order to purge 2 volumes
 - i) $V = \pi r^2 l$ where $r = 1/8 = 0.125$ inches, $l = 40$ feet = 480 inches.
 - ii) $V = \pi (0.125)^2 (480) = 23.56 \text{ in}^3$
 - iii) Convert 23.56 in^3 to cm^3 . $1 \text{ in}^3 = 16.39 \text{ cm}^3$.
 - iv) Therefore, $23.56 \text{ in}^3 \times 16.39 \text{ cm}^3 = 386 \text{ cm}^3$
 - v) Convert cm^3 to ml. $1 \text{ cm}^3 = 1 \text{ ml}$.
 - vi) Therefore, $386 \text{ cm}^3 = 386 \text{ ml}$.
 - vii) Total volume = above volume + bulb $386 \text{ ml} + 250 \text{ ml} = 636 \text{ ml}$.
 - viii) Flow rate = 200 ml/min. $636 \text{ ml} / 200 \text{ ml} = 3.2$ minutes.
 - x) 3.2 minutes to purge 1 volume
 - x) Therefore, to purge 2 volumes - $2 \times 3.2 = 6.4$ minutes.
- F) Times to purge 3-4 different volumes should be calculated. Samples should be collected at each of these times and analyzed. The volume/time that gives the highest VOC concentration should be used for all subsequent sampling. For example 1, 2, 4 and maybe 8 volumes should be done to find the optimum concentration of target compounds.

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APPENDIX C

FIELD SAMPLING PLAN

Purpose and Scope

The purpose of the proposed monitoring at the Angeles Chemical Company site is to provide data regarding the groundwater piezometric surface, water quality, and the presence or absence of FHP. Groundwater monitoring will consist of such activities as water level measurement, well sounding, detection of FHP, collection of groundwater samples, field analysis, laboratory analysis, and reporting.

Groundwater Monitoring

The depth to groundwater will be measured quarterly in each well using a decontaminated water level indicator capable of measuring to within 1/100th of a foot. Prior to and following collection of measurements from each well, the portions of the water level indicator entering groundwater will be decontaminated using a 3-stage decontamination consisting of a potable wash with water containing Liquinox soap followed by a double purified water rinse. Wells will be monitored in the order of least contaminated to most contaminated based on past analysis. For the Angeles Chemical Co. wells, the following order of wells will be followed: MW7, MW3, MW2, MW1, MW4, and MW6. Water level will be measured in all wells over the shortest possible time interval.

The well box and casing will be opened carefully so that no debris or dirt falls into the open casing. Any water that may have seeped into the well box will be removed prior to opening the well.

Once the well cap and J-Plug are removed, the water level indicator will be lowered into the well until a consistent tone is registered. Several soundings will be repeated to verify the measured depth to groundwater. The depth of groundwater will be measured from a reference point marked on the lip of each well casing. A licensed surveyor has surveyed the elevation of each reference point.

The result will be recorded on a Well Sampling Record prepared for each well. Other relevant information such as physical condition of the well, presence of hydrocarbon odors, etc. will also be recorded as appropriate on these forms.

The well sounder used for this project will also be equipped to measure free hydrocarbon product layers thicker than 0.1 inches or a separate product measuring device will be employed. Lowering the well sounder tip into a bucket of clean water at the surface after it has been withdrawn from the well will also assess the presence of hydrocarbon sheen. If free product is suspected, a clear disposable plastic bailer will be lowered into the suspect well and withdrawn. While this method does not necessarily represent the true free product thickness in the formation surrounding the well, it does provide an indication of the free product conditions within the well and a relative indication of the true product thickness. If sufficient product is present to allow sampling, this will be done during the initial monitoring round and during any subsequent round when FHP appears after being absent in a particular well for at least 2 quarters. Unless DTSC requires future assessment of silting, conditions within monitoring wells, additional well depth soundings are not planned. If future well depth measurement becomes necessary, the FHP interface probe will be lowered to the bottom of each well and the depth to the top of the well casing recorded.

Types, Locations, and Numbers of Samples

Groundwater sampling will be conducted immediately following groundwater depth measurements. Due to changes in on-site chemical storage and usage since 1995 and/or possible changes in off-site contributions to groundwater contamination, a complete suite of analysis will be performed on samples from all on-site wells screened to the Gaspar/Hollydale Aquifer (MW1, MW2, MW3, MW7). Free product present within any well will also be sampled and characterized. Due to the nearly dry state of MW4, this well will not be sampled or monitored during this or subsequent events unless appreciable increases in the groundwater level occur. Provisions for FHP monitoring, sampling for removal are presented in a separate section below.

During the initial groundwater sampling event, well MW1, MW2, MW3, and MW7 samples will be analyzed for the following constituents:

- Volatile organic compounds (VOCs) using EPA Method 8260.
- Title 22 (CAM 17 heavy metals) metals using EPA Method 6010 and 7471 for mercury.
- Total petroleum hydrocarbons - with hydrocarbon chain characterizations using EPA Method 8015 (Mod).

No sampling for semi-volatiles will be connoted based on (1) No detection of significant concentrations of semi-volatiles at the McKesson Corporation property immediately downgradient of the subject property, and (2) No historical use of these compounds at the subject facility. Groundwater analytical results for the McKesson Corporation property are presented in a report prepared by Harding Lawson Associates of Santa Ana, California dated October 30, 1992 (HLA, October 1992).

Duplicate samples will be obtained at a rate of one per every ten analyses. Duplicates will be taken from a random well selected from wells that have previously contained detectable levels of compounds.

After the first round of sampling results are obtained delusions will be made concerning which methods need to be employed for future sampling rounds and which can be eliminated based on non-detect or non-significant results.

Well Purging and Measurement of Field Parameters

Wells will be purged and sampled in the following order MW7, MW3, MW2, MW1 in order to minimize the potential for cross contamination.

Wells containing free product will not be sampled, but will be subjected to the contingency plan for free hydrocarbon product removal as described under the Free Hydrocarbon Product Removal and Disposal section. Prior to sampling, wells will be purged using a 2-inch diameter Grundfos submersible pump with new or thoroughly decontaminated clear PVC tubing. Pumps will be lowered into the well to a depth approximately 2 to 3 feet from the bottom. If special circumstances occur, such as slow recharge or equipment malfunctions, disposable bailers will be used to purge groundwater wells.

Prior to purged casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

$$V = \pi(d/2)^2 h \times 7.48$$

where:

V is the volume of one well casing of water (in gallons, 1 ft³ = 7.48 gallon);

d is the inner diameter of the well casing (in feet); and

h is the total depth of water in the well - the depth to water level (in feet).

A minimum of three casing volumes of water will be purged unless wells are purged to dryness. The purge rate will not exceed one gallon per minute. Water will be collected into a measured bucket to record the purge volume.

Prior to the start of purging in the middle of purging each casing volume, and after each well casing volume is purged; water temperature, pH, specific conductance (EC), and turbidity will be measured using field test meters and the measurements will be recorded on Well Sampling Records. Samples will be collected after these parameters have stabilized; indicating representative formation water is entering the well. Three consecutive measurements that display consistent values of all parameters will be taken prior to sampling. The temperature should not vary by more than $\pm 1^{\circ}\text{C}$, pH by more than 0.1 pH units, and specific conductance by more than 10 percent from reading to reading. Turbidity should be less than 5 NTUs. No water that has been tested with a field meter probe will be collected for chemical analysis. If these parameters have not stabilized after five casing volumes have been purged, purging will cease, a notation will be recorded in the field logbook and samples will be collected.

If a well de-waters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80 percent of the static water column, and de-watered once more. After water levels have recharged to 80 percent of the static water column, groundwater samples will be collected.

All field meters will be calibrated according to manufacturers' guidelines and specifications before and after each day of field use. Field meter probes will be decontaminated before and after use at each well. The name, model, and serial number of the field meters will be recorded on the Well Sampling Record. The calibration standards used and expiration dates will also be recorded on the Well Sampling Record. Any deviations noted during the day (e.g. meter drift) must also be recorded. If the meter drift requires an adjustment to any final values for field parameters, the results must be flagged in the database.

Well Sampling

Prior to sampling each well, the water level will be measured and the well purged as described in the previous section. Wells will be allowed to recharge for at least 15 minutes prior to sampling following a purge cycle.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled.

Samples will be collected by lowering a disposable or thoroughly decontaminated bailer into each well. Groundwater will be transferred from the bailer directly into the appropriate sample containers with preservative, if required, chilled, and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the bailer-emptying device to the sample containers.

Vials for volatile organic compound analysis will be filled first to minimize aeration of water in the bailer. Prior to sampling a test vial will be preserved with HCl to determine the amount of preservative needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample. The laboratory will provide vials containing sufficient HCl preservative to lower the pH to less than 2. The vials will be filled directly from the bottom-emptying device. If an effervescence reaction occurs to acidulants will be added to sample vials. The vial will be capped with a cap containing a Teflon septum. The vial will be inverted and tapped to check for bubbles to insure zero headspace. If an air

bubble appears, the vial contents will be emptied into the purge drum, the vial discarded, and a new sample will be collected. Trials that have been prepared with preservatives will not be overfilled.

Although metals products were not manufactured at the Angeles Chemical Co. sited there is no reason to suspect metals contamination related to site activities, groundwater samples will be analyzed for metals initially for data completeness. After well purging prior to collecting groundwater samples for metals analyses, the turbidity of the groundwater extracted from each well will be measured using a portable turbidity meter. The results of the turbidity measurement will be recorded on the Well Sampling Record. If the turbidity of the groundwater from a well is above 5 NTUs, groundwater samples will consist of both a filtered and unfiltered sample. A 0.45 pore size filter will be used to remove large particles that have been entrained in the water sample. A clean unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, the filter will be removed and an unfiltered sample will be collected. A sample number appended with an "F" will represent a sample filtered with a 0.45 μ m filter. Two times the capacity of the filtering device will be passed through the filter and discarded before samples are collected.

New nitrile gloves will be worn during by sampling personnel for each well to prevent cross contamination of the samples. A solvent free label will be affixed to each sample container/vial denoting the well identification, date and time of sampling, and an identifying code to distinguish each individual bottle.

Sample Handling

VOA vials, including laboratory trip blanks and rinse blanks, will be placed inside of one new Ziplock bag per well and stored in a cooler chilled to approximately 4°C with bagged ice. Water samples will be logged on the Well Sampling Records and on chain-of-custody forms immediately following sampling of each well to insure proper tracking through analysis in the laboratory. Notations of water quality including color, clarity, odors, sediment, etc. will also be noted on the sampling forms.

Decontamination

In order to prevent cross contamination between monitoring wells, the equipment used in the course of work will be decontaminated according to the following, procedures:

- Place all decontamination equipment including the 3-stage pump decontamination bath, scrubbers, hosing, bailer (if non-disposable) on a new sheet of visqueen measuring approximately 5- x 10-feet.
- Place pump in the first stage of a three stage decontamination bath consisting of a Liquinox with potable water wash followed by two rinse stages with potable water.
- Place the refill line from the potable water tank in the first rinse stage.
- Turn the pump on and allow wash water to recycle back into the initial wash stage for a minimum of 5 minutes.
- Place pump in the second stage, turn pump and refill line on at the same time and allow rinse water to discharge into a 55-gallon drum for a minimum of two minutes.
- Repeat rinse procedure in the second rinse stage. Allow rinse water to discharge onto the ground.

- If non-disposable bailers are used make a separate 3-stage decontamination bath consisting of an initial potable/ Liquinox wash followed by a double rinse with water treated by filtering and reverse osmosis.
- Scrub bailers/bailer cord in the initial stage for approximately 3 minutes followed by complete rinse in both rinse stages.
- Empty decontamination bath waters into 55-gallon drums for storage and disposal.

Only new VOA vials, bottles from the manufacturer's box will be used to collect groundwater samples. At the conclusion of the field investigation, accumulated wash water will be analyzed to determine how it may be disposed of, if necessary.

LABORATORY ANALYSIS

Water samples will be transported to a laboratory certified by the California EPA to perform the requested analysis. Samples will be analyzed on a normal turnaround basis under the QA/QC protocols presented in the Quality Assurance Project. Samples will be analyzed in accordance with USEPA SW-846 methods (USEPA, June 1998). As stated above, groundwater analysis to be performed during the initial sampling event include the following:

- Volatile organic compounds (VOCs) using EPA Method 8260.
- Title 22 (CAM 17 heavy metals) metals using EPA Method 6010 and 7471 for mercury.
- Total petroleum hydrocarbons - with hydrocarbon chain characterization using EPA Method 8015 (Mod).

Since the analyses for heavy metals and total petroleum hydrocarbons are intended to serve as baseline it is anticipated that subsequent sampling events will only include analysis for VOCs Using EPA Method 8260.

REPORTING

- Groundwater monitoring and sampling reports will be submitted to DTSC on a semi-annual basis. Reports will include the following information:
 - Results of groundwater elevation and free product monitoring.
 - Well purging and sampling protocols.
 - Laboratory analytical results and chain-of-custody documentation.
 - Groundwater contour map indicating current flow conditions.
 - Tabulated well construction and elevation data.
 - Tabulated analytical results including historical
 - QA/QC assessment
 - Copies of groundwater Sampling Records.
 - Results of free hydrocarbon product recovery and disposal (as appropriate).
 - Detailed description of any deviation from the GSAW.
 - Assessment of significant changes since the previous reporting period.
 - Summary and recommendations, including a discussion of any outstanding issues.

The report will be signed by the registered civil engineer under whose supervision the monitoring was conducted and by each member of the field team. The report will contain a table of contents and numbered pages.

SCHEDULE

Ground water monitoring activities will adhere to the following general schedule:

Initial groundwater level monitoring and well sampling -- last week of August 2000

- Groundwater level Monitoring -- last week of October 2000
- Semi-annual groundwater level monitoring and well sampling -- last week of January 2001

During subsequent calendar years, quarterly water level monitoring will occur during the last week of January, April, July, and October. Semi-annual well sampling will be conducted during the January and July monitoring events. If new wells are added to the monitoring and sampling program, they will be initially sampled independently of the program and subsequently during the next regularly scheduled sampling event.

CONTINGENCY PLAN

Free Product Recovery

If free product greater than 0.1 inches in thickness is noted during groundwater elevation monitoring, free product removal will be initiated. Free product removal will consist of hand-bailing affected wells until no measurable thickness is produced upon water level recovery. Wells in which free product is bailed, will be re-monitored after no more than 72 hours to ensure that no additional product has collected. If more product is indicated, the bailing and re-monitoring process will be repeated as long as necessary.

New Well Construction

In the event that new groundwater monitoring wells are needed in the future, consistent construction procedures and materials will be utilized. Monitoring of any new wells will follow the procedures outlined within the Field Sampling Plan. In general 4-inch diameter wells will be installed and screened within the Gaspar-Hollydale Aquifer. Well materials will consist of the following:

- Well casing: 2-inch diameter, schedule 40 PVC.
- Sounding tube casing: 1-inch diameter, schedule 40 PVC.
- Well screen: 2- or 4-inch diameter, schedule 40 PVC with 0.020-inch factory slots.
- Sounding tube screen: 1-inch diameter, schedule 40 PVC with 0.020-inch factory slots.
- Flush threaded end caps.
- 12-inch diameter, traffic-rated steel well box or equivalent.
- 2- or 4-inch diameter expandable "J- plug" well plug or equivalent.
- 2- or 4-inch diameter slip-type casing cap.
- Conductor casing: 10- or 12-inch diameter 1/4-inch gauge mild steel conductor casing in 5-foot flush threaded sections for wells within OU1 or where perched groundwater is anticipated.
- Well screen filter pack: No. 2-12 Monterey sand (RMC Lonestar or equivalent).
- Annular seal; Wyo-Ben Enviroplug Medium bentonite chips (or equivalent).
- Annular grout: Consisting of 3- to 5-percent bentonite/97-percent Portland cements.

- Well box cement: Rapid-Set concrete.

Well drilling will be accomplished using a standard hollow-stem auger drilling rig equipped with continuous flight, 10.25-inch O.D. augers. Where perched groundwater is anticipated, conductor casing will be driven into subsurface soils to a depth two feet below the contact between the upper zone of sand and gravel and underlying clay aquitard. Conductor casings are anticipated to be set at a depth of 25 to 30 feet dependent on the depth of the lithologic contact. Well borings will be approximately 50 feet deep.

Soil sampling will be conducted for lithologic screening purposes only. Based on previously observed lithologies, samples will be collected at five-foot intervals starting at the 5-foot depth continuing to the 20-foot depth. Selected boreholes will be continuously cored from the 20-foot depth to the 40-foot depth. Samples will be collected at 5-foot intervals to the total depth of the boring from the 40-foot depth. Soil sampling will be conducted using inch long split barrel sampler outfitted with acetate sleeves.

The top of each well screen will be set at a depth of eight feet below the top of the clay at approximately 25 feet to approximate equal piezometric depth with wells MW2 and MW3 and allow for an adequate annular seal. Well screens will be 20-feet long. A one-foot section of sand filter pack will be placed below the bottom of the well casing and above the top of the screen. Annular seals will consist of 5 feet of bentonite hydrated with approximately 5 gallons clean water per 50-pound bag. The remainder of the well annulus will be grouted with neat cement.

WASTE MANAGEMENT

Free hydrocarbon product will be stored in sealed 55-gallon drums or similar containers for period not exceeding 90 days. Stored wastes will be profiled for hazardous constituents and characterized as Non-Hazardous, California Hazardous) or RCRA Hazardous, as appropriate.

All wastes including FHP, decontamination water, well purge water, soil cuttings, etc. will be properly stored in 55-gallon drums, characterized, and disposed as appropriate. Any transportation of waste will be under appropriate manifest.

APPENDIX D

QAPP: QUALITY ASSURANCE PROJECT PLAN

1.0 Sample Collection procedures:

1.1 Soil Gas Survey

- A. Obtain all samples at depths (minimum 5' bg) adequate to minimize potential for cross contamination by ambient air.
- B. Conduct a site-specific purge volume versus contaminant concentration test at the start of the initial soil gas survey to purge ambient air in the sampling tube system with minimal disturbance of soil gas around the probe tip.
- C. Conduct task B for predominant soil type and in the area where VOC concentrations are anticipated to be at maximum levels. Perform a one volume test, then a two volume test, then a three volume test of total tube volume(as determined by $\pi r^2 h$) by GC or GCMS. Use the volume purged with maximum results as the volume removed for all other samples in that soil type.
- D. Conduct task B for each compound analyzed.
- E. The expected zone of influence for the predominately heterogeneous clayey soil is anticipated to be less than 5'.
- F. Sample cross contamination will be minimized by analysis of a method blank between unusually highly concentrated samples. Bake out and cleaning of the P/T and GCMS systems will be implemented where carryover is identified in the method blank samples.
- G. Demonstrate that the sampling equipment is free from contamination under on-site conditions by running lab reagent blanks. Avoid use of non-TFE plastic coating, non-TFE thread sealants, and flow controllers with rubber components in the purging device.
- H. Identify that the probe tip, probe and probe connectors have no spacing by visual inspection. If spacing develops as a result of probe advancement reseal the area around the probe surface to minimize the potential for ambient air intrusion. If the sampling system implements the probe rod as a conduit for the tubing, then assure a tight fit between the tubing and probe to minimize the potential for leakage and dilution of the sample.
- I. Attain a detection limit of 1 μ /L for the following target compounds:
 1. Tetrachloroethylene
 2. Trichloroethylene
 3. Cis-1,2 Dichloroethylene
 4. Trans-1,2 Dichloroethylene
 5. Vinyl Chloride
 6. Benzene
 7. Toluene
 8. Ethylbenzene
 9. Xylenes
 10. Methyl ethyl Ketone

- J. Use both a GC, and a GCMS in appropriate combinations to identify the above compounds at detection limit $1\mu\text{L}$.
- K. Properly and clearly identify all calibration standards and laboratory control samples and coinciding dates.
- L. Prepare laboratory control standards from a second, totally independent standard from the standard used for initial calibration.
- M. Coelution of any target compounds must be resolved by quantification using two different types of detectors for the coeluted compounds.
- N. Analyze the initial calibration and daily mid-point calibration check standards, laboratory control samples, blanks and collected samples using the same GFC, GCMS temperature and program.
- O. Assure that the GC/GCMS run time will allow elution of all target compounds.

INSTRUMENT CALIBRATION

Perform Gas Chromatograph and Mass Spectrometer, HP 5890 and HP 5971 or HP 5972, respectively, calibration in accordance with Appendix B, Section 8, Soil Gas Procedures and sections 3.7.0 through 4.4 (enclosure), Guidance for Active Soil Gas Investigation.

Appendix E

Appendix E: Checklist for Preparing a Groundwater SAP

- a. Since the groundwater has not been sampled for several years, constituents of concern (COC's) will be reevaluated in the groundwater during initial groundwater monitoring. The COC's have been determined from analysis results indicating detectable levels of hazardous materials/ waste and transformation compounds identified in Soil Vapor Extraction testing performed on site, groundwater and soil sampling analysis results, and site hazardous materials storage records.

The Constituents of Concern and appropriate analysis method determined for this site are:

COMPOUND:	EPA Method
Tetrachloroethylene	8260
Trichloroethylene	8260
Cis-1,2 Dichloroethylene	8260
Trans 1,2 Dichloroethylene	8260
Vinyl Chloride	8260
Methylene Chloride	8260
1,3,5-Trimethylbenzene	8260
1,2,4- Trimethylbenzene	8260
1,1,1-Trichloroethane	8260
Carbon Disulfide	8260
Trichloroethane	8260
Tetrachloroethane	8260
1,1 Dichloroethane	8260
1,2 Dichloroethene	8260
1,1 Dichloroethylene	8260
Chloroethane	8260
Chloromethane	8260
Acetonitrile	8260
Acetone	8260
Benzene	8260
Toluene	8260
Ethyl Benzene	8260
Xylenes	8260
Trimethylbenzenes	8260
Methyl isobutyl ketone	8260
Methyl tert butyl ether	8260
2-Butanone	8260

The initial groundwater sampling will include analysis for the above and semi-volatile compounds as follows:

1. USEPA Method 8270C, SVOC's

2. USEPA Method 8260, VOC's
3. USEPA Method 6010, metals
4. USEPA Method 7471A, mercury
5. USEPA Method 8015, total petroleum hydrocarbons

1. Comment 4, Schedule:

- a. BEII proposes that initial groundwater sampling be performed within 30 days of approval of the BEII/ SCS groundwater monitoring workplan.
- b. BEII agrees that DTSC will reserve the right to schedule the frequency of groundwater monitoring after review of the initial groundwater monitoring analysis results.
- c. BEII will recommend provide the DTSC with groundwater analytical results as soon as possible for evaluation.

5. New groundwater monitoring wells:

- a. No new groundwater monitoring wells will be installed as part of the SCS contingency plan contained in the GMPWP without a written proposal and approval of that proposal by the DTSC.

6. Groundwater Sample Collection, Analytical method and Container Information:

Groundwater Sample Collection Protocol and Containers:

6. USEPA Method 8270C, SVOC's , 1 liter amber gas, fill container.
7. USEPA Method 8260, VOC's, minimum 2 vials per sample 40 ml, HCL preservative, sealed to top no airspace.
8. USEPA Methods 6010, metals and 7471A, mercury, 500 milliliter plastic with HNO_3 sealed to top no airspace preservative. No extra bottles required for mercury.
9. USEPA Method 8015, total petroleum hydrocarbons, gasoline same as 8260, diesel same as 8270.

Appendix F

Appendix F

Response to May 4, 2000, DTSC comments with approval of SCS Groundwater Monitoring Program Workplan.

The "Groundwater Monitoring Program Work Plan" (GMPWP) submitted by SCS on February 29, 2000 and approved by the DTSC with comments dated May 4, 2000 will be implemented at the Angeles Chemical Company, 8915 Sorensen Avenue, Santa Fe Springs site and the comments addressed as follows:

1. Comment 1; Well Inspection and Sounding:

- a. All wells will be measured for free phase product during groundwater monitoring using an oil/water interface probe. The Angeles Chemical Company will be notified immediately of the DTSC requirement that the floating free product be bailed immediately and properly containerized, labeled and disposed. The wells tested monthly for free phase product and bailed, containerized, labeled and disposed where free product is identified.
- b. All groundwater monitoring wells should be surveyed by a California Registered Civil Engineer:

All groundwater wells were surveyed on 7/17/2000 BLC Surveying Inc., Michael Anderson, Professional Licensed Land Surveyor PLS 7041. The California plane coordinates are listed on Map 1, Enclosed.

The reference survey datum height, benchmark "Y 6667", based on the North American Vertical Datum of 1988 was identified at 155.298' above sea level. The surveyed datum points will be permanently marked on top of the inner well casing during initial groundwater monitoring.

The geographic location of all soil vapor extraction wells and soil vapor probes will be identified during soil vapor testing.

2. Comment 2; Types, locations and numbers of samples:

In addition to the analysis proposed in the February SCS groundwater monitoring program work plan following will be addressed in accordance with the DTSC comments:

- a. Since the groundwater has not been sampled for several years constituents of concern (COC's—re-evaluated per item 2A) will be reevaluated in the groundwater during initial groundwater monitoring. The initial groundwater sampling will include analysis for semi-volatile compounds as well as the COC'S (see Attachment A for COC's and test methods) follows:

1. USEPA Method 8270C, SVOC's
2. USEPA Method 8260, VOC's
3. USEPA Method 6010, metals
4. USEPA Method 7471A, mercury
5. USEPA Method 8015, total petroleum hydrocarbons

3. Comment 4, Schedule:

- a. BEII proposes that initial groundwater sampling be performed within 30 days of approval of the BEII/ SCS groundwater monitoring workplan.
- b. BEII agrees that DTSC will reserve the right to schedule the frequency of groundwater monitoring after review of the initial groundwater monitoring analysis results.
- c. BEII will recommend provide the DTSC with groundwater analytical results as soon as possible for evaluation.

5. New groundwater monitoring wells:

- a. No new groundwater monitoring wells will be installed as part of the SCS contingency plan contained in the GMPWP without a written proposal and approval of that proposal by the DTSC.

6. Groundwater Sample Collection, Analytical method and Container Information:

Groundwater Sample Collection and Containers:

5. USEPA Method 8270C, SVOC's , 1 liter amber gas.
6. USEPA Method 8260, VOC's, minimum 2 vials per sample 40 ml, HCL preservative, sealed to top no airspace.
7. USEPA Methods 6010, metals, and 7471A, mercury, 500 milliliter plastic with HNO₃ sealed to top no airspace preservative. No extra bottles required for mercury.
8. USEPA Method 8015, total petroleum hydrocarbons, gasoline same as 8260, diesel same as 8270.

Appendix G

STATE OF CALIFORNIA
California Regional Water Quality Control Board
Los Angeles Region

INTERIM GUIDANCE FOR ACTIVE SOIL GAS INVESTIGATION
(February 25, 1997)

Introduction

Volatile organic compounds (VOCs) within the unsaturated zone partition into the adsorbed, dissolved, free liquid, and vapor phases. Measurement of VOCs through an active soil gas investigation allows: 1) evaluation of whether waste discharges of VOCs have occurred which may impact groundwater, 2) determination of spatial pattern and extent of vapor phase soil contamination, 3) establishment of vapor distribution for the design of soil vapor extraction (SVE) system, and 4) determination of the efficiency of reduction in threat to groundwater from any cleanup action, including SVE. The work plan should include, but not be limited to, the following:

1.0 Survey Design

1.1

Provide a scaled facility map depicting potential sources and proposed sampling points. Include locations and coordinates of identifiable geographic landmarks (e.g., street center-line, benchmark, street intersection, wells, north arrow, property line).

1.2

Locate initial sampling points in potential source areas and areas with known soil contamination using an adjustable 10 to 20 foot grid pattern. Provide rationale for the number, location and depth of sampling points. Screen the remainder of the site with a 100-foot or less grid pattern.

1.3

Conduct a close interval (10 to 20 foot grid pattern) and multi-level sampling (5 to 10 feet vertical distance between points) in areas with known or relatively high VOC concentrations.

1.4

Use an on-site mobile laboratory with laboratory-grade certifiable instrumentation and procedures for real-time analysis of individual VOCs. Non-specific portable organic vapor analyzers and/or GC-based handheld detectors may not be used for analysis, except for daily or weekly vapor monitoring during SVE.

1.5

Maintain flexibility in the sampling plan such that field

modifications (grid pattern density, location and depth) can be made as real-time evaluation of analytical test results occurs. Include in the work plan decision-making criteria for these adjustments and explain decisions in the report. Field decisions shall be made in consultation with Regional Board staff.

1.6

Re-sample at any sampling point if anomalous data (i.e., 2 to 3 orders of magnitude difference from surrounding samples) are obtained. Board staff may require additional points to resolve the spatial distribution of the contaminants within the interval in question.

2.0 Sample Collection

2.1

Obtain samples at an adequate depth (nominally 5 feet) below ground surface (bgs) to minimize potential dilution by ambient air.

2.2

Conduct a site-specific purge volume versus contaminant concentration test at the start of the initial soil gas survey and vapor monitoring well sampling. The purpose of the test is to purge ambient air in the sampling system with minimal disturbance of soil gas around the probe tip. Conduct this test based on soil type and where VOC concentrations are suspected to be highest. Describe specific method and equipment to determine optimal purge rates and volumes. Take into account the potential sorption of target compounds to the tubing and adjust the purge rate and time to achieve the optimal purge volume. Limit the sampling vacuum to collect proper samples. Optimum purge volume may be compound specific. "Lighter" early eluting VOCs, such as vinyl chloride, may reach their highest concentration with less purging than "heavier" late eluting VOCs like PCE. Therefore, optimize the purge volume for the compound(s) of greatest concern.

2.3

Explain the expected zone of influence for sample points, taking into consideration soil types, land cover, drive point construction and sample purge rate/time/volume. The vertical zone of influence for purging and sampling must not intersect the ground surface.

February 25, 1997

2.4

Discuss soil gas sample collection and handling procedures. Discuss the procedures to prevent collection of samples under partial vacuum and the methods to minimize equipment cross-contamination between sampling points.

2.5

Avoid making a pilot hole (e.g., using a slam bar) prior to inserting the probe rod, except to drill through asphalt or concrete. The process of making a pilot hole may promote vapor contaminant aeration and result in lower sample concentration.

2.6

Specify that the sampling equipment (e.g., gas tight syringe, sorbent trap) will not compromise the integrity of the samples. Tedlar bags may only be used for qualitative analysis.

2.7

Assure that the probe tip, probe and probe connectors have the same diameter to provide a good seal between the formation and the sampling assembly. If a space develops between the probe and the formation, as a result of probe advancement, seal (e.g., with bentonite) the area around the probe at the surface to minimize the potential for ambient air intrusion.

2.8

Some sampling systems (e.g., Geoprobe) utilize the probe rod as a conduit for the tubing that connects to the probe tip. Assure a tight fit between the tubing and probe tip to minimize potential for leakage and dilution of the sample.

2.9

Follow the sampling method specified in the soil gas consultant's standard operating procedure (SOP). Discuss with Board staff any deviations from the SOP before it is implemented in the field.

3.0 Laboratory Analysis of Soil Gas Samples

3.1 Primary Target Compounds

1. Carbon tetrachloride
2. Chloroethane
3. Chloroform
4. 1,1-Dichloroethane
5. 1,2-Dichloroethane
6. 1,1-Dichloroethene
7. cis-1,2-Dichloroethene
8. trans-1,2-Dichloroethene
9. Dichloromethane (methylene chloride)
10. Tetrachloroethene
11. 1,1,1,2-Tetrachloroethane

12. 1,1,2,2-Tetrachloroethane
13. 1,1,1-Trichloroethane
14. 1,1,2-Trichloroethane
15. Trichloroethene
16. Vinyl chloride
17. Benzene
18. Toluene
19. Ethylbenzene
20. Xylenes
21. Trichlorofluoromethane (Freon 11)
22. Dichlorodifluoromethane (Freon 12)
23. 1,1,2-Trichloro-trifluoroethane (Freon 113)

3.2 Other Target Compounds

Analyze for other VOCs (e.g., methyl ethyl ketone, methyl isobutyl ketone, ethylene dibromide, petroleum hydrocarbons, etc.) based upon site history and conditions.

3.3 Detection Limit (DL)

Attain a DL of not more than 1 µg/L for all target compounds. A higher DL is acceptable only for the compound(s) whose concentration exceeds the initial calibration range.

3.4 Detectors

Use the following detectors in appropriate combinations:

Electrolytic conductivity detector (ELCD) (e.g., Hall)
Photoionization detector (PID)

Flame ionization detector (FID)
Mass spectrometer (MS)
Electron capture detector (ECD)

3.5.0 Identification of Calibration Standards & Laboratory Control Sample (LCS)

3.5.1

Properly and clearly identify all calibration standards and LCS. The identification must agree with the data on record for the standards and LCS.

3.5.2

Prepare LCS from a second source standard that is totally independent from the standards used for the initial calibration. Second source means a different supplier (whenever possible) or a different lot from the same supplier.

3.6.0 GC Conditions

3.6.1

Use a type of column that can separate all the target compounds. Coelution of the target compounds is not acceptable unless the compounds are distinguished and quantified by two different types of detectors in

use at that time.

3.6.2

Analyze the initial calibration and daily mid-point calibration check standards, LCS, blank, and samples using the same GC conditions (i.e., detector, temperature program, etc.).

3.6.3

Use a GC run time that is long enough to identify and quantify all the target compounds.

3.7.0 Initial Calibration (Record in Table 1)

3.7.1

Perform an initial calibration:

1. for all 23 compounds listed in Section 3.1;
2. when the GC column type is changed;
3. when the GC operating conditions have changed;
4. when the daily mid-point calibration check cannot meet the requirement in Section 3.8.3; and
5. when specified by Regional Board staff based on the scope and nature of the investigation.

3.7.2

Include at least three different concentrations of the standard in the initial calibration, with the lowest one not exceeding 5 times the DL for each compound.

3.7.3

Calculate the response factor (RF) for each compound and calibration concentration prior to analyzing any site samples. Calculate the average RF for each compound. The percent relative standard deviation (%RSD) for each target compound must not exceed 20% except for the following compounds which must not exceed 30%:

Trichlorofluoromethane (Freon 11)
Dichlorodifluoromethane (Freon 12)
Trichlorotrifluoromethane (Freon 113)
Chloroethane
Vinyl chloride

3.7.4

Verify the true concentration of the standard solutions used with the LCS after each initial calibration. Conduct the verification using a LCS with a mid-point concentration within the initial calibration range. The LCS must include all the target compounds. The RF of each compound must be within $\pm 15\%$ difference from the initial calibration, except for freon 11, 12 and 113, chloroethane, and vinyl chloride which must be within $\pm 25\%$ difference from the initial calibration.

3.8.0 Daily Mid-point Calibration Check (Record in Table 1)

3.8.1

Check the calibration using the calibration standard solution with a mid-point concentration within the linear range of the initial calibration before any sample is analyzed.

3.8.2

Include in the daily mid-point calibration check standard the following compounds and every compound expected or detected at the site:

1. 1,1-Dichloroethane
2. 1,2-Dichloroethane
3. 1,1-Dichloroethene
4. cis-1,2-Dichloroethene
5. trans-1,2-Dichloroethene
6. Tetrachloroethene
7. 1,1,1-Trichloroethane
8. 1,1,2-Trichloroethane
9. Trichloroethene
10. Benzene
11. Toluene
12. Xylenes

3.8.3

Assure that the RF of each compound (except for freons 11, 12 and 113, chloroethane, and vinyl chloride) is within $\pm 15\%$ difference from the initial calibration's average RF. The RF for freons 11, 12 and 113, chloroethane, and vinyl chloride must be within $\pm 25\%$.

3.9.0 Blank

3.9.1

Analyze field blank(s) to detect any possible interference from ambient air.

3.9.2

Investigate and determine the source(s) and resolve any laboratory contamination problem prior to analyzing any samples if the blank shows a measurable amount ($\geq 1 \mu\text{g/L}$) of the target compound(s).

3.10.0 Sample Analysis

3.10.1

Assure that the requirements for initial calibration, daily mid-point check, blank, and LCS are met before any site samples are analyzed.

3.10.2

Analyze samples within 30 minutes after collection to

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minimize VOC loss. Longer holding time may be allowed if the laboratory uses a special sampling equipment (e.g., sorbent trap, glass bulb) and demonstrates that the holding time can exceed 30 minutes with no decrease in results.

3.10.3

Assure that the concentrations of constituent(s) in a sample do not exceed 50% of the highest concentration in the calibration range. Reanalyze the sample using a smaller volume or dilution if the detected concentration exceed 50% of the highest concentration in the calibration range.

3.10.4

Attain DL of not more than 1 µg/L for all target compounds. If lesser sample volumes or dilutions are used to off-set possible high concentration of constituents in the initial run, use the initial run to calculate the results for constituents that are not affected by the high concentration so that DL of 1 µg/L for these compounds can be achieved.

3.10.5

Quantify sample results using the average RF from the most recent initial calibration.

3.10.6

Add surrogate compounds to all samples. Assure that the surrogate compound concentration is within the initial calibration range. Two to three different surrogate compounds [one aromatic hydrocarbon and two chlorinated compounds (early and middle eluting, except gases)] should be used to cover the different temperature programming range for each GC run.

3.10.7

Calculate the surrogate recovery for each GC run. Surrogate recovery must not exceed ±25% difference from the true concentration of the surrogate, as the sample result would be considered questionable and may be rejected by this Regional Board.

3.11.0 Compound Confirmation

3.11.1

Conduct compound confirmation by GC/MS whenever possible. Use second column confirmation with surrogate for compound confirmation if GC/MS is not used.

3.11.2

Add surrogate compounds to standards and site samples for second column confirmation to monitor the relative retention time (RRT) shift between GC runs. This is required for better compound identification when ELCD, PID, ECD, and FID are used for analysis.

3.11.3

Usually one sample is adequate and quantitation is not required for second column confirmation. Second column confirmation can be done with a different GC. The representative sample can be collected in Tedlar bag and confirmation can be done off site.

3.11.4

Second column confirmation is not necessary if the compounds present have been confirmed from previous soil gas investigations.

3.12.0 Samples with High Concentration

3.12.1

DL may be raised above 1 µg/L for compounds with high results (i.e., the limit as specified in Section 3.10.3) and those closely eluting compounds for which quantitation may be interfered by the high concentrations.

3.12.2

Quantify sample results according to Section 3.10.4 for analytes which are not affected by the high concentration compounds.

3.12.3

If high VOC concentration in an area is known from previous soil gas analysis, Sections 3.12.1 and 3.12.2 are not necessary when analyzing samples from the area in question.

3.12.4

When dilution with ambient air is used for samples with high results, dilute and analyze in duplicate each day at least one sample to verify the dilution procedure. Ambient air should be checked periodically during each day of analysis.

3.13.0 Shortened Analysis Time

3.13.1

Shorten the GC run time under the following conditions only:

1. The exact number and identification of compounds are known from previous soil and soil gas investigations; and
2. The consultant has been given permission by Regional Board staff to analyze only for specific compounds.

3.13.2

Meet the following requirements when shortening GC run-time:

1. Regional Board staff must approved the shortened run time;
2. The compounds must not coelute;
3. Perform initial calibration and daily mid-point calibration check and analyze LCS and samples under the same conditions as the shorter GC run-time;
4. Quantitate using the average RF from the initial calibration utilizing the shorter run-time; and
5. Perform a normal run-time analysis whenever peaks are detected within retention time windows where coelution, as indicated by the calibration chromatograms, is likely.

3.14.0 Last GC Test Run Per Day of Analysis (Record in Table 1)

3.14.1

A LCS as the last GC run of the day is not mandatory, except under conditions in Section 3.14.2. Include the same compounds used in the daily mid-point calibration check analysis, as listed in Section 3.8.2. Attain RF for each compound within $\pm 20\%$ difference from the initial calibration's average RF, except for freons 11, 12, 113, chloroethane, and vinyl chloride which must be within $\pm 30\%$.

3.14.2

Analyze a LCS at the detection limit concentration instead of the mid-point concentration if all samples from same day of analysis show non-detect (ND) results. The recovery for each compound must be at least 50%. If it is less than 50%, all the ND results of the samples become questionable.

3.15.0 On-site Evaluation Check Sample

3.15.1

Analyze on-site the evaluation check sample as part of the QA/QC procedures when presented with such a check sample by Regional Board staff. Provide preliminary results on-site.

3.15.2

If the results show that the soil gas consultant has problems with the analysis, all the results generated during the same day may be rejected. Correct all problems before any more samples are analyzed.

3.16.0 Site Inspection

3.16.1

Unannounced, on-site inspection by Regional Board staff is routine. Provide upon request hard copies of the complete laboratory data, including raw data for initial calibration, daily mid-point check, LCS and blank results. Failure to allow such inspection or to present these records or field data may result in rejection of all sample results.

3.16.2

The soil gas consultant must understand the instruments, analytical and QA/QC procedures and must be capable of responding to reasonable inquiries.

3.17.0 Recordkeeping in the Mobile Laboratory

Maintain the following records in the mobile laboratory:

1. A hard copy record of calibration standards and LCS with the following information:
 - a. Date of receipt
 - b. Name of supplier
 - c. Lot number
 - d. Date of preparation for intermediate standards (dilution from the stock or concentrated solution from supplier)
 - e. ID number or other identification data
 - f. Name of person who performed the dilution
 - g. Volume of concentrated solution taken for dilution
 - h. Final volume after dilution
 - i. Calculated concentration after dilution
2. A hard copy of each initial calibration for each instrument used for the past few months.
3. The laboratory standard operating procedures.

4.0 Reporting of Soil Gas Sample Results and QA/QC Data (Record in Table 1 and 2)

4.1

Report all sample test results and QA/QC data using the reporting formats in Appendix A. Compounds may be listed by retention time or in alphabetical order. Include in the table of sample results all compounds in the analyte list. Report unidentified or tentatively identified peaks. Submit upon request all data in electronic format and raw data, including the chromatograms. Identify the source(s) of the contaminants detected in the investigation, as indicated by the data.

4.2

Report the following for all calibration standards, LCS and environmental samples:

1. Site name
2. Laboratory name
3. Date of analysis
4. Name of analyst
5. Instrument identification
6. Normal injection volume
7. Injection time
8. Any special analytical conditions/remark

4.3

Provide additional information, as specified, for different types of analyses. Tabulate and present in a clear legible format all information according to the following grouping:

1. Initial calibration
 - a. Source of standard (**STD LOT ID NO.**)
 - b. Detector for quantitation (**DETECTOR**)
 - c. Retention time (**RT**)
 - d. Standard mass or concentration (**MASS/CONC**)
 - e. Peak area (**AREA**)
 - f. Response factor (**RF**)
 - g. Average response factor (**RF_{ave}**)
 - h. Standard deviation (**SD_{n-1}**) of RF, i.e.,

$$\sqrt{\frac{\sum_{i=1}^n (RF_{ave} - RF_i)^2}{(n-1)}}$$
 n = number of points in initial calibration
 - i. Percent relative standard deviation (**% RSD**), i.e., $(SD_{n-1} / RF_{ave}) \times 100 (\%)$
 - j. Acceptable range of %RSD (**ACC RGE**)
2. Daily calibration check sample
 - a. Source of standard
 - b. Detector
 - c. Retention time (**RT**)
 - d. Standard mass or concentration
 - e. Peak area
 - f. Response factor (**RF**)
 - g. Percent difference between RF and RF_{ave} from initial calibration (**% DIFF**)
 - h. Acceptable range of %DIFF (**ACC RGE**)
3. LCS. Same format as daily calibration
4. Environmental sample
 - a. Sample identification
 - b. Sampling depth
 - c. Purge volume
 - d. Vacuum pressure
 - e. Sampling time
 - f. Injection time

- g. Injection volume
- h. Dilution factor (or concentration factor if trap is used)
- i. Detector for quantitation
- j. Retention time (**RT**)
- k. Peak area
- l. Concentration in $\mu\text{g/L}$ (**CONC**)
- m. Total number of peaks found by each detector
- n. Unidentified peaks and/or other analytical remarks

5. Surrogate and second column confirmation

Mark RT and compound name on: a) second column chromatogram of standard and b) second column chromatogram of confirmation sample.

4.4

Discuss the method(s) to be used for data interpolation (contouring). Provide isoconcentration maps for each VOC detected, total chlorinated volatile organics, total aromatic hydrocarbons, and petroleum-based hydrocarbons for each sampling depth, as applicable. Provide cross-section(s) depicting the geology and changes in contaminant concentration with depth, as justified by the data.

5.0 Companion Soil Sampling

5.1

Discuss soil boring locations with Regional Board staff. Locate borings and sampling depths based on all available information including soil gas test results.

5.2

Conduct the soil sampling and analysis per this Regional Board's **Well Investigation Program General Requirements for Subsurface Investigations, Requirements for Subsurface Soil Investigation and Laboratory Requirements for Soil and Water Sample Analyses**.

6.0 Soil Vapor Monitoring Well/Vertical Profiling

Install soil vapor monitoring wells for vertical profiling in areas where significant VOC concentrations were identified during the vapor investigation. The objectives of vertical profiling are to: 1) assess the vertical distribution of VOCs in the vapor phase within the unsaturated zone, 2) determine the spatial pattern of vapor phase soil contamination at different depths within the unsaturated zone, 3) identify migration pathways at depth along which VOCs may have migrated from sources, and 4) serve as discrete monitoring points to evaluate the efficiency of a cleanup action. Soil vapor monitoring wells offer the

opportunity to resample as many times as necessary to monitor soil vapor changes over time.

Address appropriate items in the following sections when conducting vertical profiling.

6.1

Install nested, cluster, and/or multi-port vapor monitoring wells to obtain discrete multi-depth soil vapor data in the unsaturated zone. Provide a schematic diagram of the well design and a cross-section of the site showing the major lithologic units and zones for vapor monitoring.

6.2

Collect undisturbed soil samples if fine-grained soils are encountered during drilling of the boring for the probes. Due to air-stripping effect, VOC analysis of soil samples is not acceptable if air drilling method is used. Refer to Section 5.2 for sampling and testing requirements.

6.3

Use all available information (e.g., geologic log, organic vapor concentration reading) to select appropriate depths for vapor monitoring. Install probes at depths with elevated vapor readings (headspace) and/or slightly above fine-grained soils which can retard the migration of VOCs. The deepest probe should be installed above the capillary fringe.

6.4

Consider installing nested vapor probes in the annular space of the groundwater monitoring well to serve as a dual-purpose well if both vapor and groundwater monitoring are required. This design saves costs by installing vapor and groundwater monitoring wells in a single borehole.

6.5

Use small-diameter (e.g., $\leq 1/4$ -inch) continuous tubing attached from the vapor probe to the ground surface to minimize purge volume.

6.6

Design and construct the vapor wells to serve as long-term monitoring points to evaluate the efficiency of a cleanup action and soil vapor changes over time. Protect the tubing from being damaged or clogged by subsurface soil materials especially in deep installations (e.g., place inside a PVC casing) or consider using $1/2$ -inch PVC pipe in place of the tubing. If a tubing is used, consider attaching a weight at the probe tip and/or attaching the tubing onto a supporting pipe or rod to ensure that the probe tip remains in-place during installation.

Properly cap the top end of each tubing/pipe (e.g.,

control valve) and label each tubing/pipe with the correct sampling depth.

6.7

Attach the bottom-end of the tubing to an appropriate vapor probe (e.g., PVC screen, stainless steel wire screen, stainless steel probe, or brass elbow, etc). If a vacuum pump is used for purging and sampling, include a wire screen around the probe to prevent soil particles from blocking the probe's airways. Ensure that the connection between the tubing and the vapor probe is tight to prevent leakage.

6.8

Place the filter pack (e.g., sand or pea gravel) around each vapor probe and isolate each monitoring zone with bentonite seals. Use an appropriate method (e.g., tremie method) to avoid bridging or segregation during placement of the filter packs and bentonite seals.

Extend the filter pack to a sufficient distance above the probe to allow for settling of backfill materials. In general, the filter pack should not exceed 3 feet in thickness. In deep borings, the filter pack should extend about four feet above the probe to allow for settling of backfill materials and to reduce the potential for the bentonite seal settling around the probe.

Consider placing fine sand above the filter pack to prevent the bentonite seal from entering the filter pack. Place a minimum of two feet thick bentonite seal above and below the filter pack. Allow sufficient time (e.g., one-half to one hour) for bentonite seal to properly hydrate before placing filter pack or cement-based sealing materials.

6.9

Prevent infiltration of surface runoff and unauthorized access (e.g., use a locking subsurface utility vault).

6.10

Specify the schedule for sampling the vapor probes. In general, soil vapor monitoring is required a minimum of one and two months after installation. Due to the VOC stripping caused by air drilling methods, conduct soil vapor monitoring at least two and four months following well completion. Regional Board staff may require a different sampling schedule and additional sampling based upon site conditions and test results.

6.11

Specify the procedures to properly decommission vapor wells that are no longer needed. The decommissioning activity should achieve an effective and long-term seal of subsurface geologic materials and prevent cross contamination in the subsurface.

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7.0 Soil Gas Consultants

This Regional Board reserves the authority to review any soil gas consultant's work to assure compliance with all applicable statutes, regulations, orders, and guidelines. It is your responsibility to ascertain that the individual directing the field investigation is professionally qualified and conducts the field work in accordance with the Board's guidance for active soil gas investigations.

Acknowledgements

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Table 1
SOIL GAS INITIAL CALIBRATION

SITE NAME: _____ LAB NAME: _____ DATE: _____

ANALYST: _____ STD LOT ID NO.: _____ INSTRUMENT ID: _____
NORMAL INJECTION VOLUME: _____ INJECTION TIME: _____

COMPOUND	DETECTOR	1st CONC			2nd CONC			3rd CONC			RF _{ave}	SD _{n-1}	%RSD	ACC RGE
		RT/RRT	MASS/CONC	AREA RF	RT	MASS/CONC	AREA RF	RT/RRT	MASS/CONC	AREA RF				

----- OR -----

COMPOUND	DETECTOR	RT/RRT	MASS/CONC	AREA	RF	RF _{ave}	SD _{n-1}	%RSD	ACC RGE
----------	----------	--------	-----------	------	----	-------------------	-------------------	------	---------

Compound 1			<u>1st conc</u>						
			<u>2nd conc</u>						
			<u>3rd conc</u>						

Compound 2
(Surrogate)

SOIL GAS DAILY MID-POINT CALIBRATION STANDARD

AND

SOIL GAS LABORATORY CONTROL SAMPLES (LCS)

SITE NAME: _____ LAB NAME: _____ DATE: _____

ANALYST: _____ STD LOT ID NO.: _____ INSTRUMENT ID: _____
NORMAL INJECTION VOLUME: _____ INJECTION TIME: _____

COMPOUND (SURROGATE)	DETECTOR	RT/RRT	MASS/CONC	AREA	RF	%DIFFACC RGE
-------------------------	----------	--------	-----------	------	----	--------------

Table 2
SOIL GAS SAMPLE RESULTS

SITE NAME: _____ LAB NAME: _____ DATE: _____
 ANALYST: _____ COLLECTOR: _____ INSTRUMENT ID: _____
 NORMAL INJECTION VOLUME: _____

Sample ID	Sample 1	Sample 2	Sample 3
Sampling Depth			
Purge Volume			
Vacuum			
Sampling Time			
Injection Time			
Injection Volume			
Dilution Factor			

COMPOUND	DETECTOR	RT	AREA CONC	RT	AREA CONC	RT	AREA CONC
----------	----------	----	-----------	----	-----------	----	-----------

Compound 1
 Compound 2
 Compound 3

·
·
·
·
·

Surrogate 1
 Surrogate 2

Total Number of Peaks
 by Detector 1 (specify)
 by Detector 2 (specify)

Unidentified peaks and/or other analytical remarks

ALTERNATIVE FORMAT FOR REPORTING SOIL GAS SAMPLE RESULTS

SITE NAME: _____ LAB NAME: _____ DATE: _____

Sample ID Sampling Depth	Sample 1	Sample 2	Sample 3 ...
COMPOUND	CONC	CONC	CONC

Compound 1
Compound 2
Compound 3
.
.
.
.
.

SITE NAME: _____ LAB NAME: _____ DATE: _____
ANALYST: _____ COLLECTOR: _____ INSTRUMENT ID: _____
NORMAL INJECTION VOLUME: _____

Sample ID Sampling Depth Purge Volume Vacuum Sampling Time Injection Time Injection Volume Dilution Factor	Sample 1	Sample 2	Sample 3 ...
COMPOUND	DETECTOR	RT	AREA

Compound 1
Compound 2
Compound 3
.
.
.
.
.

Surrogate 1
Surrogate 2
.
.

Total Number of Peaks
by Detector 1 (specify)
by Detector 2 (specify)

Unidentified peaks and/or other analytical remarks

(Page 2 of 2, Analytical Raw Data)

(Page 1 of 2, Results Summary)

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APPENDIX H

1

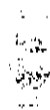
QC Analytical Procedure

EPA Method SW 8270C

QC CHECK & PROCEDURE	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	FLAGGING CRITERIA
Six-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs: ARF = ≥ 0.05 CCC : RSD for RF < 25% Quantitation Options: (1). Linear mean RSD for all analytes $\leq 15\%$ (2). Non-linear - COD > 0.990 (6 point points shall be used for second order, 6 points shall be used for third order.)	Correct the problem then repeat initial calibration	
Second-source calibration verification	Once per six-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct the problem then repeat initial calibration	
Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs: ARF ≥ 0.05 CCCs < 15% diff (when using RFs) or drift (when using least squares regression or non-linear calibration)	Correct the problem then repeat initial calibration	
Method blank	One per analytical batch	No analytes detected \geq RL	Reprep and reanalyze method blank and all samples processed with the contaminated blank	Apply B to specific analyte(s) on all associated samples
LCS	One LCS/LCSD per analytical batch	See Table of Analytes	Preprep and reanalyze the LCS and all associated samples	
MS/MSD	One MS/MSD per every 20 project samples per matrix	See Table of Analytes	None	
Check of mass spectral ion intensities using DFIPP	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description	Retune instrument and verify	
Surrogate spike	Every sample, spiked sample, standard, and method blank	See Table of analytes	Correct the problem then reextract and analyze sample	
MDL study	Once per 12 month period	Detection limits established shall be 3 to 5 times less than the PQL	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Results reported between MDL and PQL	N/A	N/A	N/A	Apply J to all values between MDL and PQL

PQL - 3 to 5 times of MDL

Appendix I



Appendix I; Sampling and Analysis Plan -SAP

A. Groundwater: - included in the enclosed and previously approved, without comment, SCS groundwater monitoring plan.

B. Soil Gas Analysis- Appendix D.

Each member of the field team will sign a document stating that he/she has read and understands the current version of the SAP.

Field Data sheets will be kept in dated, signed logbooks maintained separately for each groundwater monitoring well and in groups of 5 to 10 for soil vapor survey wells. Each log book will be titled with the well location, depth, elevation, diameter, and usage. Each log entry will be in ink and will describe test methods, field procedures and sample collection, containment, and sealing.

For groundwater the electric oil/water interface probe will be calibrated at the beginning of each workday and recorded in each daily well log book.

Well head conditions and suggested maintenance will be identified in each well log book.

Sample containers and preservation will be performed in accordance with Attachment B, section C.

Preservatives will be used in sample containers to ensure pH <2 for metals analysis. The APCL laboratory will be interviewed to assure that metals samples have been preserved at pH <2 for metals analysis and that temperature upon arrival will be maintained at 4° Celsius. At least 1 temperature measurement will be performed during shipping to ensure that the temperature has been maintained at 4° Celsius.

Equipment and procedures for collecting groundwater samples are specified in Appendix G.

Filter usage protocol for metal sample collection is specified in the previously approved SCS groundwater monitoring program plan attached to this document.

Sample container bottles prepared with preservatives will not be overfilled.

Equipment and procedures for storing samples for transport and forms and procedures for transport have been previously presented and approved in the SCS groundwater monitoring workplan.

Analytical methods to be performed for each sample are specified in the previously approved SCS workplan and, again, in Appendix B of this document

Each member of the field team will sign a document that all field measurements and samples were collected in accordance with the SAP and that field necessitated changes if any will be signed.

ATTACHMENT A

TTL 17 METALS

Dilution Factor

ANTIMONY	6010	mg/kg	5	10
ARSENIC	6010	mg/kg	0.3	5
BARIUM	6010	mg/kg	1	10
BERYLLIUM	6010	mg/kg	0.2	2
CADMIUM	6010	mg/kg	0.2	2
CHROMIUM	6010	mg/kg	0.5	5
COBALT	6010	mg/kg	0.5	5
COPPER	6010	mg/kg	0.5	10
LEAD	6010	mg/kg	0.3	5
MERCURY	7471	mg/kg	0.2	0.5
MOLYBDENUM	6010	mg/kg	0.2	5
NICKEL	6010	mg/kg	0.3	5
SELENIUM	6010	mg/kg	0.5	10
SILVER	6010	mg/kg	0.5	10
THALLIUM	6010	mg/kg	0.5	10
VANADIUM	6010	mg/kg	0.5	5
ZINC	6010	mg/kg	0.5	10

mg/L

CADHS ELAP No.: 1431 NFESC Approved since 11/01/94

ANINS000154

Component Analyzed	Method	Unit	PQL	100.1 00
DICHLORODIFLUOROMETHANE	8260	µg/kg	5	µg/L
1,1-DICHLOROETHANE	8260	µg/kg	5	same
1,2-DICHLOROETHANE	8260	µg/kg	5	
1,1-DICHLOROETHENE	8260	µg/kg	5	
CIS-1,2-DICHLOROETHENE	8260	µg/kg	5	
TRANS-1,2-DICHLOROETHENE	8260	µg/kg	5	
1,2-DICHLOROPROPANE	8260	µg/kg	5	
1,3-DICHLOROPROPANE	8260	µg/kg	5	
2,2-DICHLOROPROPANE	8260	µg/kg	5	
1,1-DICHLOROPROPENE	8260	µg/kg	5	
CIS-1,3-DICHLOROPROPENE	8260	µg/kg	5	
TRANS-1,3-DICHLOROPROPENE	8260	µg/kg	5	
ETHYLBENZENE	8260	µg/kg	5	
HEXACHLOROBUTADIENE	8260	µg/kg	5	
ISOPROPYLBENZENE (CUMENE)	8260	µg/kg	5	
P-ISOPROPYLTOLUENE	8260	µg/kg	5	
METHYLENE CHLORIDE	8260	µg/kg	5	
4-METHYL-2-PENTANONE (MIBK)	8260	µg/kg	50	
METHYL-T-BUTYL ETHER (MTBE)	8260	µg/kg	10 5	
NAPHTHALENE	8260	µg/kg	5	
N-PROPYLBENZENE	8260	µg/kg	5	
STYRENE	8260	µg/kg	5	
1,1,1,2-TETRACHLOROETHANE	8260	µg/kg	5	
1,1,1,2,2-TETRACHLOROETHANE	8260	µg/kg	5	
TETRACHLOROETHENE	8260	µg/kg	5	
TOLUENE	8260	µg/kg	5	
1,2,3-TRICHLOROBENZENE	8260	µg/kg	5	
1,2,4-TRICHLOROBENZENE	8260	µg/kg	5	
1,1,1-TRICHLOROETHANE	8260	µg/kg	5	
1,1,2-TRICHLOROETHANE	8260	µg/kg	5	
TRICHLOROETHENE	8260	µg/kg	5	
TRICHLOROFLUOROMETHANE	8260	µg/kg	5	
1,2,3-TRICHLOROPROPANE	8260	µg/kg	5	
1,2,4-TRIMETHYLBENZENE	8260	µg/kg	5	
1,3,5-TRIMETHYLBENZENE	8260	µg/kg	5	
VINYL CHLORIDE	8260	µg/kg	5	
XYLENE (TOTAL)	8260	µg/kg	5	

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract

N.D.: Not Detected or less than the practical quantitation limit. " ": Analysis is r

J: Reported between PQL and MDL.

Listed Dilution Factors (DF) are relative to the method default DF. All values are in

Component Analyzed	Method	Unit	PQL	109-A- 00-0
SEMI-VOLATILE ORGANICS, ABN FRACTIONS				mg/L
Dilution Factor				
ACENAPHTHENE	8270	µg/kg	500	10
ACENAPHTHYLENE	8270	µg/kg	500	
ANTHRACENE	8270	µg/kg	500	
BENZO(A)ANTHRACENE	8270	µg/kg	500	
BENZO(A)PYRENE	8270	µg/kg	500	
BENZO(B)FLUORANTHENE	8270	µg/kg	500	
BENZO(G,H,I)PERYLENE	8270	µg/kg	500	
BENZO(K)FLUORANTHENE	8270	µg/kg	500	
BIS(2-CHLOROETHOXY)METHANE	8270	µg/kg	500	
BIS(2-CHLOROETHYL)ETHER	8270	µg/kg	500	
2,2'-OXYBIS(1-CHLOROPROPANE)	8270	µg/kg	500	
BIS(2-ETHYLHEXYL)PHTHALATE	8270	µg/kg	500	
4-BROMOPHENYLPHENYLETHER	8270	µg/kg	500	
BUTYL BENZYL PHTHALATE	8270	µg/kg	500	
4-CHLORO-3-METHYLPHENOL	8270	µg/kg	1000	
4-CHLOROANILINE	8270	µg/kg	1000	20
2-CHLORONAPHTHALENE	8270	µg/kg	500	10
2-CHLOROPHENOL	8270	µg/kg	500	
4-CHLOROPHENYLPHENYLETHER	8270	µg/kg	500	
CHRYSENE	8270	µg/kg	500	
DI-N-BUTYL PHTHALATE	8270	µg/kg	500	
DI-N-OCTYL PHTHALATE	8270	µg/kg	500	
DIBENZ(A,H)ANTHRACENE	8270	µg/kg	500	
DIBENZOFURAN	8270	µg/kg	500	
1,2-DICHLOROBENZENE	8270	µg/kg	500	
1,3-DICHLOROBENZENE	8270	µg/kg	500	
1,4-DICHLOROBENZENE	8270	µg/kg	500	
3,3'-DICHLOROBENZIDINE	8270	µg/kg	1000	
2,4-DICHLOROPHENOL	8270	µg/kg	500	
DIETHYL PHTHALATE	8270	µg/kg	500	
DIMETHYL PHTHALATE	8270	µg/kg	500	
2,4-DIMETHYLPHENOL	8270	µg/kg	500	
4,6-DINITRO-2-METHYLPHENOL	8270	µg/kg	2500	50
2,4-DINITROPHENOL	8270	µg/kg	2500	50
2,4-DINITROTOLUENE	8270	µg/kg	500	10
2,6-DINITROTOLUENE	8270	µg/kg	500	
FLUORANTHENE	8270	µg/kg	500	
FLUORENE	8270	µg/kg	500	
HEXACHLOROBENZENE	8270	µg/kg	500	
HEXACHLOROBUTADIENE	8270	µg/kg	500	
HEXACHLOROCYCLOPENTADIENE	8270	µg/kg	500	50

Component Analyzed	Method	Unit	PQL	109-A- 00-0
HEXACHLOROETHANE	8270	µg/kg	500	10
INDENO(1,2,3-CD)PYRENE	8270	µg/kg	500	↓
ISOPHORONE	8270	µg/kg	500	
2-METHYLNAPHTHALENE	8270	µg/kg	500	
3/4-METHYLPHENOL (M/P-CRESOL)	8270	µg/kg	500	
2-METHYLPHENOL	8270	µg/kg	500	
NAPHTHALENE	8270	µg/kg	500	50
2-NITROANILINE	8270	µg/kg	2500	
3-NITROANILINE	8270	µg/kg	2500	
4-NITROANILINE	8270	µg/kg	2500	
NITROBENZENE	8270	µg/kg	500	
2-NITROPHENOL	8270	µg/kg	500	10
4-NITROPHENOL	8270	µg/kg	2500	50
N-NITROSO-DI-N-PROPYLAMINE	8270	µg/kg	500	10
N-NITROSODIPHENYLAMINE (1)	8270	µg/kg	500	10
PENTACHLOROPHENOL	8270	µg/kg	2500	50
PHENANTHRENE	8270	µg/kg	500	10
PHENOL	8270	µg/kg	500	↓
PYRENE	8270	µg/kg	500	
1,2,4-TRICHLOROBENZENE	8270	µg/kg	500	
2,4,5-TRICHLOROPHENOL	8270	µg/kg	500	
2,4,6-TRICHLOROPHENOL	8270	µg/kg	500	

Component Analyzed	Method	Unit	PQL	10:
VOLATILE ORGANICS				
Dilution Factor				
ACETONE	8260	μg/kg	100	
BENZENE	8260	μg/kg	5	
BROMOBENZENE	8260	μg/kg	5	
BROMOCHLOROMETHANE	8260	μg/kg	5	
BROMODICHLOROMETHANE	8260	μg/kg	5	
BROMOFORM	8260	μg/kg	5	
BROMOMETHANE	8260	μg/kg	5	
2-BUTANONE (MEK)	8260	μg/kg	100	
N-BUTYLBENZENE	8260	μg/kg	5	
SEC-BUTYLBENZENE	8260	μg/kg	5	
TERT-BUTYLBENZENE	8260	μg/kg	5	
CARBON DISULFIDE	8260	μg/kg	5	
CARBON TETRACHLORIDE	8260	μg/kg	5	
CHLOROBENZENE	8260	μg/kg	5	
DIBROMOCHLOROMETHANE	8260	μg/kg	5	
CHLOROETHANE	8260	μg/kg	5	
CHLOROFORM	8260	μg/kg	5	
CHLOROMETHANE	8260	μg/kg	5	
2-CHLOROTOLUENE	8260	μg/kg	5	
4-CHLOROTOLUENE	8260	μg/kg	5	
1,2-DIBROMO-3-CHLOROPROPANE (DB)	8260	μg/kg	5	
1,2-DIBROMOETHANE (EDB)	8260	μg/kg	5	
DIBROMOMETHANE	8260	μg/kg	5	
1,2-DICHLOROBENZENE	8260	μg/kg	5	
1,3-DICHLOROBENZENE	8260	μg/kg	5	
1,4-DICHLOROBENZENE	8260	μg/kg	5	

same for water
μg/L

ATTACHMENT B

Attachment B:

Quality Assurance Project Plan-Soil Vapor Survey

A. PROJECT DESCRIPTION:

1. Purpose:

Groundwater Monitoring:

This project consists of groundwater monitoring of four (4) available groundwater monitoring wells, MW7, MW3, MW2, MW1 at the Angeles Chemical Company (site), 8915 Sorensen Avenue, Santa Fe Springs, CA.

2. Data Usage:

Data will be used for determination of the need for additional monitoring wells, if any, and remediation of the subsurface soil and groundwater.

B. PROJECT ORGANIZATION AND RESPONSIBILITIES:

1. Project team organization- Project manager, James Jazmin, California Registered Civil Engineer, Field Technicians -Blaine Field Services, Administration-Ms. Melanie Self.
2. Regulatory Oversight-DTSC

C. DATA QUALITY OBJECTIVES:

1. Data measurement objectives

Data will be measured to begin delineation of the dissolved and free phase contaminant plumes in and floating on the groundwater.

1.a. Field procedure Quality assurance guidance- Appendix G

1.a. Laboratory Quality assurance guidance-Appendix H

1.b. Precision, Accuracy, representativeness, completeness and comparability (PARCC)

1. Precision-3 to 5 times less than Practical Quantitation Limit for each compound of concern tested.
2. Accuracy-to detection limits.
3. Representativeness-to be determined after initial groundwater sampling review by DTSC.
4. Completeness-This is an initial groundwater monitoring episode-completeness is not anticipated.
5. Comparability-this initial groundwater monitoring will be used and the comparative episode future monitoring events.

2. Field Measurements:

- a. In accordance with the previously approved SCS Groundwater Monitoring Plan and the Standard Operating Procedures for groundwater bailing (Appendix G). Where standards may conflict the more accurate measurement criteria will prevail.

3. Laboratory Analysis:

- a. Analytical methods and detection limits
 1. Gasoline, EPA 8020, 1 PPMillion
 2. Benzene 5 PPBillion
 - Ethylbenzene "
 - Toluene "
 - o-Xylene, EPA 8020 "
 3. m/p Xylene, EPA 8020 10 PPB
 4. MTBE 25 PPB
 - 5.

3.

- b. Quality Control Analysis-Appendix H
- c. Quality Control Acceptance-Field and Laboratory Standard Operating Procedures and Quality Control specifications must be met.

D. Sample Collection:

1. Sampling design-Samples will be collected in sequence from the least to most contaminated wells -MW7, then MW3, then MW2, and then MW1.
- 2., 3, 4-Sampling Equipment, Containers, Collection-

Groundwater Sample Collection and Containers:

- a. USEPA Method 8270, SVOC's, 1 liter amber gas.
- b. USEPA Method 8260, VOC's, minimum 2 vials per sample 40 ml, HCL preservative, sealed to top no airspace.
- c. USEPA Methods 6010/7471, metals, 500 milliliter plastic with HNO₃ sealed to top no airspace preservative. No extra bottles required for mercury.
- d. USEPA Method 8015, total petroleum hydrocarbons, gasoline same as 8260, diesel same as 8270.

5. Sampling Handling and Shipping: Page 11 of the approved SCS GMWP

E. Sample Custody/Documentation

1. Field sample custody and documentation

- a. Field logbooks and records-note sample collection details on well logbooks and chain of custody
 - b. Photographs-photographs of each sample will be taken during collection and affixed to the logbook for that well.
 - c. Sample Labeling-each sample will be labeled with the well number and depth, time of collection, collector, and type of analysis.
 - d. Custody seals-tape with date and collector signature will be will be affixed to the cap of each container.
 - e. Chain of Custody Records-will contain the following: the field sample number, sample description, Date and time collected, sample matrix, preservation, number of containers, analysis methods, specific remarks, QC requirements, Sample Disposal requirements, Sample conditions, Relinquishing person and date and time.
 2. Laboratory sample custody and documentation-to be signed upon receipt by the receiving laboratory.
 3. Corrections to documentation-to be initialed by the correcting party.
- F. Analytical Quality Control Procedures:

1. Laboratory quality assurance program-Appendix H
2. Laboratory standard operating procedures-please see EPA license for APCL laboratories.
3. Field and Laboratory quality control samples
 - a. Field samples will be collected in duplicate, with one sample analyzed and one sample archived for 96 hours.
 - b. Blanks and spikes will be will be required for each EPA method.
- 4,5,6,7 Laboratory quality control, Instrument calibration, preventative maintenance, Internal quality control and corrective action will be performed according to EPA licensing requirements.
8. Data calculation -according to EPA licensing requirements-Reporting units-milligrams per liter.
9. Documentation and deliverables-mailed analysis results and QC documentation.

G. Data Quality Assessment and Management

1. Data Quality Assessment and Management

H. Quality Assurance Oversight

1. Performance and system audits-project manager will submit one known VOC inoculated standard to the APCL laboratories for performance evaluation.
2. Corrective actions-will be determined after preliminary sampling.
3. Quality Assurance report- a quality assurance report and records will be submitted by the on-site California Registered Civil Engineer/project manager.

4. QAPP Implementation- the QAPP will be reviewed and initialed by the project manager and field personnel on-site, prior to implementation of groundwater sampling.
5. QAPP revisions or amendments-will be implemented at the pre-sampling meeting at the instruction of the California Registered Civil Engineer/project manager.

ATTACHMENT C

Standard Operating Procedure

SAMPLE COLLECTION FROM GROUNDWATER WELLS USING BAILERS

Sampling with a Bailer (Stainless Steel, Teflon or Disposable)

1. Put new Latex or Nitrile gloves on your hands.
2. Determine required bottle set.
3. Fill out sample labels completely and attach to bottles.
4. Arrange bottles in filling order and loosen caps (see Determine Collection Order below)
5. Attach bailer cord or string to bailer. Leave other end attached to spool.
6. Gently lower empty bailer into well until water is reached.
7. As bailer fills, cut cord from spool and tie end of cord to hand.
8. Gently raise full bailer out of well and clear of well head. Do not let the bailer or cord touch the ground. If a set of parameter measurements is required, go to step 9. If no additional measurements are required, go to step 11.
9. Fill a clean parameter cup, empty the remainder contained in the bailer into the sink, lower the bailer back into the well and secure the cord on the Sampling Vehicle. Use the water in the cup to collect and record parameter measurements. Fill baler again and carefully remove it from the well. Slowly fill and cap sample bottles. Fill and cap volatile compounds first, then semi-volatile, and then inorganic. Return to the well as needed for additional sample material.
10. Fill bailer again and carefully remove it from the well.
11. Slowly fill and cap sample bottles. Fill and cap volatile compounds first, then semi-volatile, then inorganic. Return to the well as needed for additional sample material.

Fill 40-milliliter vials for volatile compounds as follows: Slowly pour water down the inside on the vile. Carefully pour the last drops creating a convex or positive meniscus on the surface. Gently screw the cap on the eliminating any air space in the vial. Turn the vial over, tap several times and check for trapped bubbles. If bubbles are present, repeat process.

Fill 1 liter amber bottles for semi-volatile compounds as follows: Slowly pour water into the bottle. Leave approximately 1 inch of headspace in the bottle. Cap bottle

Field filtering of inorganic samples using a stainless steel bailer is performed as follows: Attach filter connector to top of full stainless steel bailer. Attach 0.45 micron filter to connector. Flip bailer over and let water gravity feed through the filter and into the sample bottle. If high turbidity level of water clogs filter, repeat process with new filter until bottle is filled. Leave headspace in the bottle. Cap bottle.

Field filtering of inorganic samples using a disposable bailer is performed as follows: Attach 0.45 micron filter to connector plug. Attach connector plug to bottom of full disposable bailer. Water will gravity feed through the filter and into the sample bottle. If high turbidity level of water clogs filter, repeat process with new filter until bottles is filled. Leave headspace in the bottle. Cap bottle.

12. Bag samples and place in ice chest.
13. Note sample collection details on well data sheet and Chain of Custody.

Standard Operating Procedure

WELL WATER EVACUATION (PURGING) WITH BTS 1.75" STAINLESS STEEL POSITIVE DISPLACEMENT PUMP

The BTS 1.75" Stainless Steel Positive Displacement Purge Pump is modeled after the EPA approved USGS/Middleburg Positive Displacement Sampling Pump. It is suitable for purging wells with diameters greater than 2" at depths up to several hundred feet.

The pump is actuated with compressed air from an electric, oil-less air compressor mounted on the Sampling Vehicle. The air travels to the pump via a single hose. Water is pushed out of the pump and up a second hose to the surface. The rate of water removal is relatively slow and loss of volatiles is almost non-existent. There is only positive pressure on the water being purged. There is no impeller cavitation or suction acting on the water. The pump can be placed at any location in the well and can draw water from the very bottom of the well. The pump is virtually immune to the erosive effects of silt or lack of water that can destroy other types of pumps.

Purging with the BTS 1.75" Stainless Steel Positive Displacement Pump

1. Position pump hose reel over the top of the well.
2. Start the air compressor so that it can build pressure.
3. Connect the influent air hose and effluent water hose of the reel to the pump.
4. Gently unreel and lower the pump into the well to the desired depth, typically several feet of the well bottom. Use caution when contacting the well bottom.
5. Secure the hose reel.
6. Connect the effluent water line extension to the hose reel. Attach the extension to a graduated 5-gallon bucket or other receptacle.
7. Connect the control box air-line to the hose reel.
8. Turn the switch on the control box to the "on" position to commence purging.
9. Adjust water recharge duration and air pulse duration for maximum efficiency.
Expect not more than 1.0 GPM when pumping from 0 - 100 feet below grade and not more than 0.5 GPM when pumping from depths greater than 100 feet below grade.
10. Upon removal of first casing volume, fill clean parameter cup with water.
11. Use the water in the cup to collect and record the required parameter measurements.
12. Continue purging until second casing volume is removed.
13. Collect parameter measurements.
14. Continue purging until third casing volume is removed.
15. Collect parameter measurements. If parameters are stable, stop purging. If parameters remain unstable, continue purging until stabilization occurs or the fifth casing volume is removed.
16. Upon extension from the hose reel, gently recover the pump and secure the reel.
Sample the well as required.

Standard Operating Procedures

ROUTINE DECONTAMINATION OF BTS 1.75" STAINLESS STEEL POSITIVE DISPLACEMENT PUMP

1. Remove pump and hose from well.
2. Place pump and hose into fixed Stainless Steel sink.
3. Scrub non-phosphate soap on outside of pump and hose in sink.
4. Spray outside of pump and hose with hot de-ionized water generated by onboard Hotsy Steam Pressure Washer until all soap has been removed.
5. Allow sufficient time for hot de-ionized water to thoroughly decontaminate outside of hose and pump.
6. Reel remaining hose from sink onto take up reel.
7. Remove pump from hose.
8. Connect Pressure Washer wand tip to hose. Spray inside of hose with hot de-ionized water until hot water exits the opposite opening. Continue for at least one minute.
9. Connect Pressure Washer wand tip to pump. Spray inside pump with hot de-ionized water until hot water exits the opposite opening. Continue for at least one minute.
10. Reconnect hose and pump.

Soil Gas Sampling LARWQCB Sites

Standard Operating Procedure

Soil Gas Sampling at LARWQCB Sites

by: Todd Hanna, Vironex®

Introduction

This document is prepared specifically to address the requirements of California regulatory agencies for conducting soil gas investigations. The following pages refer specifically to the collection of soil gas samples.

Equipment

Vironex® operates a mobile sampling unit capable of collecting soil, groundwater, and soil gas samples to depths in excess of 40 feet below ground surface. The Vironex sampling unit is operated by a highly trained field technician. Every Vironex field technician is HAZWOPER certified and medically monitored. Field equipment and sampling systems used by Vironex are as follows:

- | | |
|---|---|
| -Geoprobe® model 6600/5400/4220 hydraulic sampling system | -60+ feet of hardened steel probe rods |
| -Carrier vehicle - Ford F-250/Ford F-550/Kubota Track | -Expendable point holder and points |
| -Vacuum/Volume System | -Post Run Tubing(PRT) System |
| -Pump flow regulator | -Polyethylene, Teflon, and Silicon Tubing |

Sampling Procedures

Vironex uses the soil gas sampling procedures as described by Geoprobe Systems in their 1998/99 equipment catalog.

Soil gas samples are collected at discrete depths using the Vacuum/Volume System to purge and draw a sample through the PRT System. Vironex uses polyethylene tubing through which the sample is drawn. The tubing is discarded after each sample. A regulator is placed in line with the polyethylene tubing to control flow rate while purging and collecting samples. A maximum pump rate of 200 cc/min. or lower will be used during sample collection whenever possible. Deviation from this may occur when subsurface conditions warrant an increased flow rate to achieve a desired sample. Standard Operating Procedures(SOP) for sample collection using the Vacuum/Volume and PRT Systems are attached to this document.

The sample train may be purged using a syringe in lieu of the Vacuum/Volume System. The in-line regulator will not be necessary to control pump rates for this method of sample purging and collection. Designated purge volume requirements will be recognized for either method of collection. Purge volumes are determined at the first sampling location of the workday. Volumes of 1, 3, and 6 should be purged and samples collected after each purge. The sample yielding the highest concentrations will determine the standard purge volume for that work day and job site. Samples will only be extracted with a clean syringe after purging and when the sampling train has reached atmospheric pressure, as indicated by the line pressure gauge. Samples are delivered immediately to the on site mobile lab for analysis.

A minimum sampling depth of 5 feet below ground surface is recommended to minimize sample dilution with atmospheric air.

Dedicated vapor probes can be installed for single and multi-depth applications. Stainless steel-screened implants are installed with polyethylene or Teflon tubing. For specific instructions for installation, please see attachment.

Decontamination of down hole tooling occurs after each sample.